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FOOD AND THE STRATEGY OF PEACE

THE United Nations Conference on Food and Agriculture which has just ended at Hot Springs, Virginia, brought together representatives of forty-four nations to consider the world problem of food distribution after the War. It has been described, not inaccurately, by the editors of *Fortune* as the first of the peace conferences to end the War, and for the first time in history we are witnessing the planning of the strategy of peace while the objectives of war are still far from their fulfilment. The Conference has yet to be followed by action, it is true, but on its face value its declarations and decisions give reasonable ground for the belief that an important blow has been struck for sanity in world economics.

The recommendations show that most of the time and expert knowledge of the delegates to the Conference were devoted to the problem of providing more and better food for 2,000 million people to eat. Almost all their proposals for the expansion of production, the improvement of nutrition and the increase of consumption are specifically directed to this end. The prior charge on each country will be to provide the foods of high nutritional value such as milk, other dairy produce, vegetables and fruit, which are mostly perishable and best produced as near as possible to the centres of production. The want and need of these protective foods is almost unlimited. Beyond this basic domestic priority, consumption needs must be met from the most efficient sources of production wherever they may be found, with specific safeguards for the conservation of soil and its fertility.

Essentially this programme is a manifesto for freer trade and the international division of labour. Equally it is a programme of full employment—the development of industries and of purchasing power in backward areas as well as the maximum output of the right foodstuffs in the right places. It is not a policy of *laisser-faire* or of cut-throat competition, and although guarantees of stable prices to efficient producers to prevent the collapses which have been a bane in the past are essential to success, the protection of producers and restriction of supply by high tariffs or quantitative restrictions on imports must be firmly excluded. The protection of consumers and the maintenance of demand by social security measures or subsidies to special classes must be the weapons of policy.

The principal decision of the Conference is the creation of a permanent international organization, on the lines of the International Labour Organisation, to secure collaboration on measures to increase production, distribution and consumption of food. Until the permanent organization can be established, an interim commission is to function in Washington, meeting not later than July 15. This Commission will be responsible for the promotion and co-ordination of research, and for the collection and dissemination of information. It will submit to the individual Governments recommendations for action along the

lines agreed by the Conference, and will examine such questions as the development of agricultural resources, commodity arrangements, consumer co-operatives, land tenure and other subjects considered at the Conference.

Besides this section concerned with the permanent machinery to implement its recommendations, the Conference was organized in three other sections, each divided into a number of committees, responsible for examining particular aspects of the general problem.

The report of the first section, on consumption levels and requirements, stresses the relation between malnutrition and poverty and gives a picture of "world-wide under-consumption, malnutrition and its attendant evils". Three-quarters of the 1,150 million inhabitants of Asia are living below decent health standards; malnutrition exists among the lower income groups of the United States and Europe; there are widespread deficiencies in tropical Africa, the West Indies and other colonial territories, and the War has aggravated a situation already serious. Without formulating a uniform set of dietary standards for general application, certain broad principles are laid down, and such standards as those evolved by the League of Nations Technical Commission on Nutrition are universally applicable. Advances in nutritional science permit the establishment of minimum dietary requirements in terms of calorie, protein, mineral and vitamin content. Government promotion of systematic education in food values, special provision for pregnant women, nursing mothers, infants and adolescents and the development of community services, school meals and factory canteens are recommended.

The second section, which examined the expansion of production and adaptation to consumption needs, distinguishes between the short-term and the long-term objectives. First, it recommends an immediate increase wherever possible in the acreage of crops for direct human consumption, even at the expense of postponing the replenishment of livestock herds. While the shortages continue, the governments, individually and collectively, should endeavour to co-ordinate national production policies and the means of transport and distribution, and should take measures to prevent speculation and price fluctuations. Countries which, owing to their freedom from the impact of war, have been producing more than their normal output should maintain or expand their production and develop the manufacture of farm machinery and fertilizers.

The period of transition will involve considerable adjustments in policies. The long-term policy of each nation should be to increase the efficiency of production through better farming methods, measures for soil conservation, the encouragement of research, and the exploitation of undeveloped areas through land clearance, drainage and irrigation projects; and to introduce changes designed to foster the production at home of protective and relatively perishable foodstuffs. Nations should not attempt artificially to produce nutritionally desirable foods which can easily be obtained elsewhere. Besides measures designed to improve agricultural efficiency and promote research, this section of the Conference recommends that, to facilitate occupational adjustments, countries with large populations in relation to their agriculture should develop suitable industries for processing and preserving their own produce, and should be assisted to export processed articles rather than raw materials, and to import machinery and tools.

The recommendations of the third section, on the facilitation and improvement of distribution, are less definite, depending as they do on international agreement in the wider field of reconstruction. The Conference recognizes that the key to the long-term problem lies in full employment, with generally increased purchasing power and improved standards of living. The need for maintaining a balance between agriculture and industry is recognized, and international trade barriers and restrictions are denounced. In the immediate post-war period it will be necessary to ensure the most economic distribution of available supplies and to avoid price fluctuations and unrestrained competition. Under-nutrition will necessitate international action on a large scale, and international commodity arrangements will be necessary: these should allow effective representation of consumers, the maintenance of adequate reserves and the orderly disposal of surpluses. Other recommendations are international standardization in methods of processing, preserving, storing, packing and transport; measures for protecting the consumer from unfair trade practices; and full use of such war-time developments as dehydration.

So much for the general programme, the technical soundness of which can scarcely be questioned. The translation of recommendations into action, however, involves the overcoming of long-standing political obstacles, national and sectional. While, for example, the maintenance of health in Britain during the War shows what can be achieved through a scientific nutrition policy and the planned distribution of basic foodstuffs, in Britain no less than elsewhere agriculture is unbalanced and distorted, and with vested interests created in uneconomic farming. The farming forced on nations by war-time scarcities and the severance of communications is poles apart from the programme of abundance that co-operation and common sense could devise in a peaceful world, and is dangerously close to the narrow nationalistic aspirations of politicians and producers.

That is the first issue upon which the Governments of the world must fasten. To translate into specific terms this vision of an efficient and fruitful world agriculture, based on the expansion of world production according to a functional division of tasks, will demand not only all the help that the proposed permanent international organization can give it, but also the understanding support of public opinion everywhere. That the public interest must overlay discussion is a principle that must be firmly applied. Fortunately there are already welcome signs that education in this matter is proceeding apace. The recent *Fortune* report on "Relations with Europe" is an American example. Recognition of the importance of widening the areas of free trade and, when the

Anglo-American and the European free-trade areas are well established, linking them and making them one, together with the recognition that reparations should be limited to payments in kind—the only reparations that make economic sense—are far in front of the outlook of 1919. On European economic and agricultural development the proposals of this *Fortune* report are strikingly in line with the broad trend of the Conference recommendations, and it is to be hoped that progressive opinion in Great Britain will not only welcome these proposals and recommendations but also lose no time in formulating a post-war agricultural policy in harmony with them.

The second point which requires emphasis is that the Conference reconnoitred only one sector of a large front. Originally it was intended that the Conference should confine its attention to post-war problems, but while in response to many appeals it considered also problems close at hand, it was not directly concerned with the relief measures that will be needed as new areas are liberated from the Axis. It could not ignore the problems of production which must be solved if food supplies on the scale needed to relieve hunger are to be forthcoming, but the Conference can only rightly be regarded as the forerunner of other conferences of the United Nations, the work of which will be complementary to its own in laying down the strategy of the peace.

Food strategy is only a part, though an essential part, of that wide strategy, and the new world organization to be set up will provide the indispensable general staff for research, discussion of policy and advice to Governments. It will provide the centre for the collection of statistics and information and the co-ordination of policies. Such an organization is the more essential in view of the third point that stands out from the briefest review of the work of the Conference, namely, the intimate relation of this food strategy to the strategy of the attack on the problems of unemployment, disease and other evils which stand in the way of the realization of freedom from fear and from want. So far as Great Britain is concerned, this involves the special issues put forward in the Scott Report and ultimately in the Beveridge Report. Raising the standard of living and nutrition among all the nations must have profound effects on the domestic policy of every country in agriculture. Indeed the Conference enables us to glimpse something of the framework for a policy of general advance—for the establishment of full employment and social security.

We are brought, therefore, once more to realize that, complex as are the many problems involved in the establishment of a world order of full employment, social security and freedom from want, none of the interlocked problems can be considered in isolation. We must always have regard to the wider background, national and international, into which our decisions and policies have to fit. Moreover, as the work of the Conference clearly shows, it is that wider view that really gives us hope of a solution. Seen against the background of the Hot Springs Conference, assumption *C* of the Beveridge Report has a reasonable prospect of fulfilment, and we may well hope that in further discussions on the Barlow Report, the Scott Report and the Beveridge Report, and in the overdue decisions as to the policy to be pursued, this larger background will not be forgotten but will assist in the formulation of bold policies and sound but courageous strategy.

There is evidence that this wider view is gaining acceptance. It is well put by Oswald Stein, chief of the Social Insurance Section, International Labour Office, in an article, "Building Society Security", which has recently been reprinted from the *International Labour Review*. Viewing the place of social security services in post-war reconstruction, he points out that such services should be conceived as an interdependent whole, intended to take care of, preserve and develop labour forces by ensuring their maximum productivity, and also their fair share in material progress even when their period of active participation in production has passed. Moreover, social security is limited to the aims of preventing and controlling the common risks of life, and meeting those needs which are not only vital for the individual but at the same time essential for the moral and economic welfare of society as a whole. Such limitations exclude any collective guarantee tending to diminish the vital assets of individual effort and initiative.

Into this same framework fit the cardinal objectives outlined in the *Fortune* report: peace through a common military security; freedom through a common bill of rights; prosperity through a common economic life, while here, as in the draft agreement for establishing the United Nations Relief and Rehabilitation Administration, is also the recognition that relief and rehabilitation will give the United Nations their first chance to transform their military alliance into a peaceful alliance with humanitarian and constructive aims. The relief scheme is the essential preliminary to the long-term programme of the Hot Springs Food Conference for realizing a world free from want, and it is at least a hopeful portent that the suggestions should come from an American periodical that the pooling of transport and communication facilities involved in relief and rehabilitation should be a step to the permanent unification of transport, and that the reappearance of autarchic tariffs, which clearly will not be allowed to interfere with the import of military and relief goods, should be postponed for ever.

Further evidence of the trend of American opinion can be found in the declaration adopted by the delegates of twenty-one countries at the Inter-American Conference on Social Security at Santiago de Chile in September last, which related social security to the full achievements of the four freedoms and set forth a continental programme as well as visualizing a contribution to world solidarity and the attainment and maintenance of peace. In Great Britain a recent Planning broadsheet, "Employment for All", which cannot be analysed here, makes an important contribution to the discussion first of the guiding principles of a policy for full employment and second of the operation of those principles in the setting of the immediate post-war years. Even

more important is the draft agreement for the creation of a United Nations Relief and Rehabilitation Administration which the United States Government, after consultation with the British, the Soviet and the Chinese Governments, has recently put before the United Nations.

This comprehensive plan for administering relief in the wake of the armies of liberation is of importance in relation to food strategy, for several reasons. It is the first step towards a balanced economy in which a high level of consumption will prevent the piling up of great stocks of surplus goods in all the primary producing countries. Relief and rehabilitation is the opening phase of the post-war era, and the recent address of Herbert Lehman, at present director of the Foreign Relief and Rehabilitation Operations of the United States, who is expected to be the first director-general of the new organization, shows how American opinion is facing the situation.

Secondly, the proposals, like those of the Food Conference, indicate a clearer understanding of the continuity of war and peace. All such schemes imply the retention for some time after the War of controls over food, raw materials and transport, as well as some of the national rationing schemes. The organization of common action for peace as for war must be based on the pooling of available resources and a common policy, and a common control to govern their distribution. It should be the business of every citizen of goodwill to promote that understanding, and the Food Conference and the relief agreement supply abundant material for that work—a task which admittedly the British and American Governments should themselves undertake with more vigour and less diffidence than they have hitherto shown.

A third encouraging sign is not merely the shift in emphasis from the political and constitutional to the social and economic factors in post-war reconstruction, but also the attempt to work out the implications of this shift in emphasis on an international scale. These attempts to provide for the immediate needs of food, medical supplies and clothing, and then for the reconstitution of the economic life of Europe in a way offering means of livelihood to its peoples for the future, are far more urgent and far more hopeful than the fixing of frontiers, establishment or re-establishment of constitution and conclusion of international pacts which preoccupied the peace-makers at Versailles. The functional and strictly practical character of the organizations now being set up by the United Nations as the framework of their continued co-operation after the War encourages the hope that the lessons of the past are being learned. If further, profiting again by the failure in 1918 to use such tried machinery as the Allied Transport Council and Food Council, we turn to our post-war purposes such organizations as the various Combined Boards for Food, Shipping, Production and Raw Materials, and the regional organizations such as the Middle East Supply Centre, there should be every reason for confidence that, with the help of all this experience and this established machinery for advice and execution, it should be possible to gain time for the creation and growth of new loyalties and combinations of interest, in addition to national ties. Such an outlook will be of immense importance when the time comes for the establishment of new international organizations endowed with full authority to deal with problems of health, food and agriculture, which can only be effectively handled over areas transcending national frontiers. Large as may be the responsibilities of the world's Governments, there still lies on each citizen the responsibility of endeavouring to understand the implications of the situation and of assisting his fellows to grasp it. By these means full support may be obtained for necessary action, even if it may appear to threaten sectional or even narrowly national interests. This is not to suggest that love of one's country is a thing of the past. There is still room for patriotism, but there must in addition be love of humanity; one can surely be built up on the well-tried foundations of the other, to provide an edifice in which there is safe lodging for world understanding and peace.

EDUCATION: FOR WHOM AND FOR WHAT?

SOME time ago a document which, rather inaccurately, became known as the Board of Education's "Green Book", was issued in order that ideas on the future shape of Great Britain's educational system might be discussed and clarified. Copies were not, for what seem to have been quite sound reasons, to be obtained by any save selected bodies. Almost inevitably, however, it appears to have become the most widely known 'secret' document of modern times. The result, nevertheless, has justified its preparation and circulation: for, ever since its issue, all kinds of bodies have embodied their own suggestions in pamphlets of varying hues. The National Union of Teachers was one of those bodies, and, more than a year ago, published its own "Green Book" under the title of "Educational Reconstruction".

The difficulty with all these documents, however, is that they are couched in the language—or is it the jargon?—which the expert tends to use when talking to other experts. Dipping at random among the pages we may find a sentence like this: "In the interim we recommend that the principles of the present Grant Formula, which is a combination of a per capita and percentage grant, be continued". That is, doubtless, an excellent recommendation, and its effect, if it be accepted, may profoundly influence the education and prospects of thousands of students. But it is very doubtful whether it will stimulate any great interest or excitement in the breasts of the majority of parents who want improvements in the educational opportunities of their children but know little or nothing of the intricacies of the system which should produce those opportunities.

Clearly, if educational reconstruction is to be successful, parents must know what it is all about and be anxious to see it put into operation. They cannot do that unless the matter be explained

to them in simpler and less technical terms than are normally used by teachers and administrators.

For that reason we believe a new pamphlet issued by the National Union of Teachers meets a very definite need. Its main title is "A Plan for Education"; but it also has a sub-title which gets right to the heart of the matter: "The National Union of Teachers discusses with parents the Kind of Education they want for their children and how to get it".

The pamphlet explains that, since we are fighting for the democratic way of life, it is imperative that, in the very midst of the battle, we should plan such post-war conditions as will enable us to reap the fruits of victory. There are numerous aspects of the general plan now being prepared, but its base must be the provision of a good education.

What, however, is this 'good education' which all parents would like their children to have? The pamphlet answers the question not in a learned discourse but in simple sentences which he who runs may read. "There are few of us," concludes one paragraph, "who do not constantly feel a sense of our own limitation in the enjoyment of life and in the power to seize interesting opportunities when they come our way. We feel we are only half-educated." That is the kind of approach which ought to be successful because it says plainly what so many thousands of inarticulate people feel vaguely but never attempt to express.

In the same simple language this notion of a good education is amplified. The importance of physical as well as mental growth is brought out. "If you are not a hundred per cent fit and healthy, you can't enjoy life to the full." From that point of view the importance of nursery education, school buildings, the school medical and the welfare services are fitted to the picture.

Mental growth is obviously more difficult to assess, but the pamphlet goes on to explain why it is so often retarded. To that end causes in the present educational system which result in failures who ought never to be failures are indicated. Finally, the part played by inequality of opportunity is vigorously discussed. "Some children are taught in splendid buildings, others in disgraceful buildings; some in large classes, others in small; some stay at school until 18, others must leave at 14; some have the chance . . . of going to the university or technical college, others must work at uninteresting jobs . . . and feel defrauded all the rest of their lives."

But the matter is not allowed to rest there. The parents to whom the pamphlet is addressed are told that it is no use always blaming someone else for these shortcomings. If they want this "good education" for their children they must try intelligently to secure it. The job, they are told, comes back to them. "Not 'theirs', 'ours', is the task of seeing that the boys and girls of this generation have an education worthy of the democratic ideal for which their fathers are fighting."

If after so plain a statement, ordinary men and women who read the pamphlet still fail to turn their opportunities to account, the fault at any rate will not rest with those responsible for this pamphlet.

A STUDY OF THE ROBIN

The Life of the Robin

By David Lack. (Bird-Lovers' Manuals.) Pp. 200+6 plates. (London: H. F. and G. Witherby, Ltd., 1943.) 7*s.* 6*d.* net.

ORNITHOLOGY has made notable contributions to general biology during the present century. The student of species-formation, of adaptation, of animal population, of ecology, of behaviour, or of courtship and sexual selection cannot neglect the ornithological literature, for it is there that he is likely to find many of his clearest and best worked out examples. Field-work has been as important as museum or laboratory study, and the contributions of British field-workers have been among the most important.

Lack's book on the robin is in the best traditions of modern British ornithology. It is the result of intensive field observation, backed by scientific method and combined with experiment, and once again demonstrates how much of value there is to learn about our most familiar wild species.

He definitely explodes the myth that the parent robin fights with its young, and finally demonstrates that the elaborate posturing, so often described as courtship display, is found in both sexes, and is entirely concerned with aggressive threat towards intruders. He makes the interesting suggestion that the recrudescence of full song found in the robin and many other species, just after the young have left the nest but are still under parental care, is an adaptation to teach the young birds the proper song of the species. This suggestion could be checked by discovering whether this recrudescence of song is absent in species where the song does not have to be learnt in whole or in part, but is wholly innate.

His study of courtship in the robin has led him to an interesting extension of the idea first thrown out by the present reviewer thirty years ago, that the main biological function of certain types of courtship (for example, mutual display in grebes) lies in their providing an emotional bond between the pair. Lack is now inclined to think that courtship feeding, wherever it occurs, has a bond-forming function, as opposed to the stimulative function of display and certain symbolic actions. One is tempted to generalize this still further and to suggest that bond-forming courtship is likely to occur, in addition to stimulative courtship, in all or most bird species in which the co-operation of the pair is needed to rear the brood.

Lack's ringing methods have established that the British robin is partly migratory, and he suggests that it is in process of transition from a migratory to a non-migratory status. Extending the work of American ornithologists with stuffed mounts, he has shown that, although a robin is capable of extraordinary visual discrimination, such as the recognition of its mate at a considerable distance, yet its aggressive behaviour, normally directed against intruders on its territory, is elicited by the crude "signal" constituted by the red breast. While a stuffed adult whose red breast had been painted a dull brown failed to elicit attack, an isolated red breast, "sans head, sans wings, sans tail, sans everything", was attacked in fifty per cent of the trials. Like other intensive field-studies, but perhaps with special force, Lack's has demonstrated the extent of variability in temperament and behaviour: this constitutes an important section of the reservoir of evolutionary

plasticity which is required if a species is to be able to meet changes in environmental conditions.

Some of Lack's difficulties over the theoretical interpretation of bird behaviour are perhaps exaggerated. The reviewer, for example, fails to see why repeated and intensified display should not be expected to act as a more efficient stimulus to an unresponsive mate (p. 72); or why a "drive" should not be as readily produced by natural selection as any other adaptation of functional organization (p. 171). But these are trivial points. Lack's book can be warmly commended not only to the general biologist but also to the layman interested either in birds or in biology. It is well illustrated, fully documented, interspersed with delightful titbits of historical information, and discusses many of the particular problems raised by the robin's behaviour in the light of a wide knowledge of the ornithological literature. It is eminently scientific, and also very readable.

JULIAN HUXLEY.

GEM TESTING

Gem Testing for Jewellers

By B. W. Anderson. Pp. 220. (London: Heywood and Co., Ltd., 1942.) 7*s*. 6*d*. net.

AS its author remarks in the preface, this book "has been written mainly with the ordinary jeweller and dealer in view". It is, indeed, a praiseworthy attempt to give the otherwise unaided layman a working knowledge of the physical methods and instruments commonly employed in gem testing and also to provide him with the necessary data on which to base his identifications. Mr. Anderson brings to the task a wide experience in gem testing, gemmological teaching and research, and jewellers are indebted to him for making available to them so much of his knowledge of precious stones in a readily assimilable form. There is much useful information for anyone interested in gem-stones, and the book is deserving of a wider public than its title suggests.

The twenty-three short chapters fall into two sections. In the first of these the necessary instruments and methods are described in simple but clear language and with sufficient detail to enable the novice to master them without other assistance. Refractometers, dichroscopes and colour filters, specific gravity methods, microscopes and spectroscopes are discussed, and advice is given on the purchase of suitable equipment. A chapter on the detection of synthetic stones is included in this section.

The remaining chapters deal with the identification of gem-stones and other gem materials. In each case the specific characteristics of the material under consideration are discussed, then the methods for their determination, those involving the minimum of apparatus being given first. Finally, possible imitations and other gems with which that under discussion may be confused are examined. At the end of each chapter is a useful table listing the properties of the group just considered. That his method of treatment amounts to a classification based on colour is recognized by the author, who discusses its defects in some detail. While some will certainly dissent, the reviewer is inclined to agree with the author in thinking that the end justifies the means. Those who disagree will appreciate an alphabetical summary of gem species provided in the appendix, which also contains a glossary, notes on the crystal systems, a list of useful books with brief reviews and specific gravity and refractive index tables.

Of the forty-three illustrations, about half are photomicrographs of inclusions and other internal and surface features of natural and synthetic stones. These give a very clear idea of the phenomena and form a valuable adjunct to the text.

A very full index (about 700 items) adds considerably to the usefulness of the book, which is in bold, clear type on good-quality paper and, with the exception of the 23-page advertisement supplement, is a pleasing production.

THE FIRST STAGE FROM BARBARISM

The Making of Modern New Guinea

With Special Reference to Culture Contact in the Mandated Territory. By Stephen Winsor Reed. (Memoirs of the American Philosophical Society, Vol. 18.) (Issued in co-operation with the International Secretariat, Institute of Pacific Relations.) Pp. xix+326. (Philadelphia: American Philosophical Society, 1943.)

PUBLICATION of this report has been delayed through the outbreak of war with Japan. The research was carried out in 1936 on behalf of the Institute of Pacific Relations, the object being to discover the effects of contact with Europeans upon native cultures in the Mandated Territory of New Guinea. A previous report in 1928 dealt with proposed methods of carrying out the administrative policy towards the primitive Papuan tribes; the present inquiry is on the actual changes attributable to the influence of Europeans.

Beginning with the landing of early explorers, foreign influences are carefully traced to the present day by references to the abundant literature on New Guinea. More than half the volume consists of this interesting and valuable material from records of pioneers, travellers, traders, miners, squatters, missionaries, government officials, etc., both before and after the Germans assumed rights over the Territory, and finally under the administration of the Australian Commonwealth.

In order to gain first-hand experience of native cultures, the author accompanied an American anthropologist, Dr. J. W. M. Whiting, to the Upper Sepik and studied a mountain tribe, the Kwona, for six months. Later, three months were spent in observing the lives of natives who were in direct contact with white men.

Chapter 7 concerns the very difficult and controversial questions of the reaction of the Papuan to white man's culture.

The author has not made it sufficiently clear at the outset whether he considers the ultimate aim of the Commonwealth should be the welding of Papuans and Europeans into a corporate community, or the administration of a plural society without any social unit interfering unduly with another. It depends upon which view is taken as to how far the Australian Government is supposed to have fallen short of its ideal.

As a paternal Government putting the rights of the Papuans before all else, the author admits that the Government has undoubtedly made great efforts

in the face of many difficulties, but he is of the opinion that the form of education given to the natives is not calculated to prepare them for independence or self-government, which should be the aim of all democratic governments. He considers also that the superiority of Europeans ought not to be so strongly emphasized as in the relative positions of master and subordinate, and he does not agree with the Australian insistence upon a colour-bar.

This personal attitude is observable in the author's approach to problems in the latter part of the report, where he describes the sophisticated native and his adaptation to new conditions in a general survey of the semi-civilized population of employees, dependent upon many introduced commodities and living in close contact with Europeans.

The volume is valuable as a contribution of material from all sources to form a basis for the inquiry, but it is uncertain that the inquiry has actually been answered. For where such delicate problems as changes in innate cultural beliefs are in question a far more critical investigation of factors seems to be necessary, as well as an anthropological approach to these subjects. Further, information obtained through the clumsy linguistic medium of pidgin-English needs to be very carefully checked on any occasion, but particularly in matters which the Papuan has difficulty in expressing even in his native tongue.

There are slight errors. On p. 82 it is stated that British annexation of the South-East Territory followed the German, but actually the reverse is the case. On p. 260 a paper relating to castes is quoted, but this was written upon the natives of the Solomon Islands and not those of New Guinea, among which those castes do not exist.

P. 29, "fermented drinks are completely absent in New Guinea"; also in the footnote—the only mention of kava is from the Admiralty Group. Wollaston recorded that the fermented sap of the sugar palm (*Arenga saccharifera*) was being drunk by natives in the South Division, Netherlands New Guinea ("Pygmies and Papuans", 1912, chapter 8). Kava is made in the Western Division, Papua ("Handbook of the Pacific Islands", 1921).

L. EVELYN CHEESMAN.

SHORTENED PHYSICS

(1) Mechanical Physics

By Prof. Herbert Dingle. (Nelson's Aeroscience Manuals.) Pp. 248. (London and Edinburgh: Thomas Nelson and Sons, Ltd., 1942.) 5*s*. net.

(2) Sub-Atomic Physics

By Prof. Herbert Dingle. (Nelson's Aeroscience Manuals.) Pp. 272. (London and Edinburgh: Thomas Nelson and Sons, Ltd., 1942.) 5*s*. net.

(3) University Physics

By Dr. F. C. Champion. Part 5: Electricity and Magnetism. Pp. vii+246. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1942.) 7*s*. 6*d*. net.

PROF. DINGLE'S two small books form a balanced course of physics, not including mechanics. They begin at the post-matriculation stage, assuming a slight knowledge of mechanics and of the calculus, and they attain a level, on the standard of the University of London, somewhere between the physics of Intermediate Science and that of the General B.Sc. They treat ordinary academic physics and are not specially "aero". The explanations are easily read and almost all very clear, the diagrams abundant and satisfactory, the paper good, the print excellent, and the price low. There are indexes and exercises. A welcome addition to the usual course of physics is a chapter on sidereal and solar time, with diagrams of the celestial sphere. An original feature is the broad grouping of the subject-matter into "mechanical" and "sub-atomic" books; the former including gravitation, elasticity, surface tension, viscosity, heat and sound; whereas the "sub-atomic" book includes optics, electricity and magnetism. In explanation of this arrangement the second book has a chapter on the structure of the atom. But it is placed at the beginning, at a stage where the student cannot yet understand the experimental evidence. This dogmatic chapter may whet the appetite of some students, but discourage others.

In the optical section the focal-length of a converging lens is taken to be negative, contrary to the convention recommended in 1934 by a committee of the Physical Society.

There are a few mistakes which should be rectified before students believe them: It is fused silica, not quartz as stated on 1, 109, which has a much smaller coefficient of expansion than glass. It is contrary to chemical usage to state, as on 2, 17, that "the halogens (fluorine, chlorine, etc.) . . . are strong bases". Inside a permanent magnet there is reason to believe that the vector which flows continuously, without reversal at each pole, is the induction, and not, as stated on 2, 184, the magnetic force. The unit of magnetic intensity is dynes per unit pole, and not simply dynes as stated on 2, 209.

Dr. Champion's book covers the syllabus in electricity and magnetism of the London General B.Sc. It begins at the amber-and-lodestone level and proceeds rapidly, by using the calculus and by extending from easily understood examples to bold generalizations. The electron is introduced at an early stage as a tentative hypothesis. There are plenty of diagrams, most of them quite simple and clear. But where clarity can only be attained by perspective, or other graphic elaboration, the diagrams are of various quality, and a few are unsatisfactory, namely those of the post-office box, of the attracted disk electrometer and of the cathode ray oscillograph. Engineers as a class set a good example to physicists in the art of drawing apparatus.

The print is good, the paper fair; there is an index; there are exercises at the end of each chapter, and a hundred quantitative problems, followed by hints and answers, towards the end of the book.

Beginners are apt to be bothered by the standard argument about the mechanical force on a charged conductor. Dr. Champion does it with apparent ease (p. 23) by putting a unit charge in a small hole in the conductor. But is this novel argument valid without much fuller analysis? Surely the field inside the hole is far from uniform.

This book will get the student through his examination. But we are often told that one of the chief advantages to be gained from a scientific education is the insight into scientific method, and a critical habit of judging evidence. Books of the present compressed type, such as (1), (2) and especially (3), that have been printed during the paper-shortage for the use of students attending shortened courses, are more likely to form the habit

of jumping to conclusions in obedience to some phrase of authority, such as: "Now clearly . . ." Various matters on which the physicists of former generations had serious doubts, which they settled by prolonged experimentation and argument, tend to be presented to the war-time student as if they were intuitively obvious. Of course, the transition from original notebook, through research pamphlet, to text-book must always involve an enormous rejection and much compression. But let us hope that, when conditions are favourable, there may be a return to the style in which more of the romance and discipline of past researches and controversies is retained.

The dogmatism of Dr. Champion's otherwise clear and readable text will be remedied, so far as the mathematical aspect of the subject is concerned, if the student will work through the hundred examples at the end of the book. As for the habit of judging experimental evidence, it is well that the universities insist on laboratory work. L. F. RICHARDSON.

PAPER MILL LABORATORY TECHNIQUE

A Laboratory Handbook of Pulp and Paper Manufacture

Incorporating the fourth edition of Stevens's "Paper Mill Chemist". By Dr. Julius Grant. Pp. viii+320+8 plates. (London: Edward Arnold and Co., 1942.) 28s. net.

MUCH of the technique of the paper mill laboratory is specialized and described only in papers distributed throughout an extensive literature: it is therefore useful to have in this single volume short descriptions of the most reliable methods of procedure, and references for those who wish to study any particular subject in detail. Probably because of an attempt to keep down the bulk of the volume, many of these descriptions are unfortunately rather sketchy and it is doubtful whether the mill chemist, approaching a given determination for the first time, could in all cases complete it successfully from the brief instructions given. For the same reason, the text is not very critical, nor does it discuss fully the difficulties which one is apt to encounter in practice; so that in general it conveys the impression that the determinations are easier to carry out than they really are. This book, then, should be regarded not as a substitute for a library, nor as a collection of instructions to be followed blindly on all occasions, but rather as a guide to methods and a pointer to sources of information.

In the first chapter, Dr. Julius Grant describes how the scientific worker in a paper mill has to have a good working knowledge of general chemistry, physics and chemical engineering, combined with a personality capable of winning and retaining the respect and confidence of the mill operatives. He has three main tasks. First, he has to examine thoroughly all new raw materials, and check deliveries from usual sources; unsatisfactory batches must not be allowed to reach the mill, and he will be expected to advise on the best way of utilizing materials which, though not up to standard, are nevertheless still usable. Secondly, he has to check the various stages of manufacture in order to guide the operatives in their work and ascertain whether the processes have been carried out efficiently. The third part of his duties is to examine customers' complaints; and, where time and resources permit, to conduct original research on paper problems. Certainly a wide field.

The second chapter deals with the processes of isolating reasonably pure cellulose fibres from the raw materials, with sections on 'cooking', bleaching and the evaluation of cellulose, lignin, etc. Non-fibrous raw materials, such as lime and caustic soda, and the recovery of spent liquors, are discussed in the next chapter. Chapter 4 deals with the preparation and examination of standard test sheets made from the 'half-stuff' and the determination of its 'freeness', moisture content, etc. In Chapter 5, the various operations which take place in the beater house are considered, with special reference to the effect of beating, loading, sizing and colouring on the properties of the resulting paper. The final stages in the conversion to paper are described in Chapter 6. Here are sections on the care of the machine wire, drying cylinders and felts, and the examination of 'backwater'. The 'after-processes' considered include calendering, tub sizing, 'conditioning', coating, waxing and gumming. Paper testing by physical methods is described in Chapter 7. The importance of proper sampling and testing at a definite relative humidity and temperature is stressed, and most of the current tests for thickness, strength, colour, gloss, etc., are outlined. Testing by chemical and microscopical means is dealt with in the next chapter, which includes sections on loading and pigments, ash, acidity and *p*H, metals and acid radicals, cellulose and mechanical wood content, resins, and starch. The main microscopical tests are for fibre identification and furnish, and the determination and identification of dirt particles. The last chapter deals with tests for papers for special purposes, and contains short sections on statistical analysis of data and testing of water and fuel. A number of useful tables are contained in an appendix.

The text is clearly written apart from a few loosely constructed sentences, and there are a few grammatical errors: for example, "to 50 ml. of this *are* added sufficient ammonia" (p. 45); "papers which must *lay* flat" (p. 164). How far the use of numerals in text matter is permissible is always difficult to decide, but contractions like "between 2 rolls", "into 3 main categories" (p. 174) are surely unnecessary and ugly, except in abstracts. What few misprints there are seem to occur mainly among the numerals. The mean wave-length of white light is not 0·05 μ (p. 117); for a "narrow spectral range" 10 A., and not 1000 A., is intended (p. 204); and the "160 mm. objective" on p. 246 should read "16 mm. objective". It is unnecessary to give the viscosity of glycerol as 871.700 centipoises (p. 84) when it is to be used for calibrating a simple flow viscometer; three significant figures would have been ample.

The make-up of the volume is good, except in a few places. For example, Fig. 22, referred to on p. 194, is not inserted until facing p. 258, and the reader is given no indication where it may be found. With the general reservation that the book tends to suffer from over-condensation, it can be recommended. One hopes that the day is not far distant when it will again be possible to test butchers' wrapping paper (p. 272) with "slices of beef liver (2×4×0·5 in.)"! V. G. W. HARRISON.

SCIENCE IN SOUTH-WEST CHINA

I. THE PHYSICO-CHEMICAL SCIENCES

By DR. JOSEPH NEEDHAM, F.R.S.
British Council Cultural Scientific Mission in China

OWING to the course of the War and world conditions, Free China has now been isolated from the rest of the world for such a long time that an account of what our Chinese scientific colleagues have been doing will surely be of interest to readers of NATURE both in Britain and the United States. During the past few weeks, since my arrival, I have had excellent opportunities of seeing the work of Chinese men of science in all branches of their work, and the present opportunity of presenting a short account of it to the scientific workers of the other United Nations is an important one.

Kunming, the capital of Yunnan province, is an ancient Chinese city lying at the northern end of an extensive lake, in a large plain surrounded by mountains. The whole region, with its equable and sunny climate, both winter and summer, must be one of the most beautiful in the world, since the plain is not so large that the mountains are ever out of sight. An intensive agriculture is carried on, aided by an elaborate system of dykes and canals, their banks often raised high above the surrounding fields, and planted with pine-trees, conveying water from the mountain-sides, and dating from the Yuen Dynasty (about A.D. 1200). The scientific institutions are well scattered at different distances from the city, and transport is by horse-cart, charcoal-burning bus, 'jeep', lorry or car.

The National Associated South-Western University

The National Associated South-Western University (Hsi-nan Lien-ho Ta-Shioh), formed by a coalescence of Peiping, Chinghua and Nankai Universities, and perhaps the greatest teaching centre in Free China, has a campus not far from the city. President Mei Yi-Chi (the physicist) attends to internal and local affairs and President Chiang Mon-Lin (educationist) attends to outside affairs. Both are outstanding personalities, embodying the ideal of the Chinese scholar. All the departments are housed in 'hutments' built of mud brick, and roofed very simply with tiles or tin sheets, though some have curving roofs in the great tradition of Chinese architecture. Inside, the floors are beaten earth, with a little cement, and extreme ingenuity has been used in fitting up laboratories for research and teaching under these conditions. For example, since no gas is available, all the heating has to be done with electricity, and hence when the supply of element wire for heaters (home-made out of clay) ran out some time ago, work was at a standstill until it was found that gun lathe shavings from one of the Yunnan arsenals would do very well. When hæmatoxylin became unobtainable, it was found that a dye something very like it could be obtained from an orange-coloured wood native to Yunnan, *Cæsalpinia sappan*. When microscope slides could not be had, window-panes broken by air raids were cut up, and the unobtainable cover-slips were replaced by local mica. For glass-blowing, the blowpipes are fed with the vapour of power alcohol (derived from molasses) passed through electric furnaces. Instances could be multiplied at length.

The campus of the University lies in scenery somewhat resembling Upper Deeside, with its pine-trees and hills in the distance. There are no air-raid shelters, and the population scatters to the hills if a raid looks like being serious. Built into the floors of each mud-brick building are large petrol drums, and all the most valuable apparatus is lowered into these when the siren goes, in order to preserve it against anything but a direct hit. Even in its humble buildings, the Associated University has been bombed several times and many of the rows of huts destroyed.

In the Physics Department of the University (visited with Dr. Wu Yo-Hsün, dean of the Faculty of Science) the main research going on is on the distribution and other properties of cosmic rays, by Drs. Chao Chung-Yao and Ch'ang Wên-Yü (both from the Cavendish Laboratory, Cambridge). But as might be expected under present difficult conditions, more theoretical work is proceeding, and Dr. Wu Ta-Yo recently published an important book on the vibrational spectra of molecules, which was printed just before the fall of Shanghai, and a copy of which has been sent to the Cavendish Laboratory. Radio physics problems are being studied by Ma Se-Chun and Ma Ta-Yo, and mathematical physics, thermodynamics, etc., by Wang Ch'u-Hsi (a pupil of Sir Ralph Fowler) and Huang Tzu-Ching. Prof. Yao Yu-Tai (dean of the Faculty of Science at Peiping University) and Prof. Hsiung Ching-Lai had as their pupil the eminent young mathematician, Hua Lo-Kung, a collaborator of Prof. G. H. Hardy.

The chemical side is mainly directed by Profs. Yang Shih-Hsien and Tsêng Chao-Lun, both organic chemists. One of the principal problems is the investigation of the alkaloids and glucosides in the anti-malarial drugs of the classical Chinese pharmacopœia; this is of much importance in relation to the existing world quinine shortage. There is also a group working with Dr. Ch'u Rju-Hua at the Peiping Institute; her interest lies in the migration aptitude of groups in phenanthrene pinacol compounds, and in the possible relation of vitamin K to the sulphanilamide drugs. Prof. Tsêng and his collaborators are working on glycol lubricants. Unfortunately, as in all the other chemical laboratories I have seen here, the work is seriously hampered by lack of chemical reagents, and the supply of these seems almost more immediately necessary than the supply of books and periodicals. Chemical engineering is taught by Dr. Hsieh Ming-Shan (a pupil of Sir Alfred Egerton), and among the physical chemists is Chien Jen-Yuen (a pupil of Prof. C. N. Hinshelwood). It was a pleasure to see on the shelves of the working library a complete set of the *Journal of the Chemical Society* and other journals, presented by the University of Oxford.

Not all the research institutes of Peiping, Chinghua and Nankai Universities were absorbed into the United University. Out at Dragon King Pool, about two hours distant from the city, are some of the Chinghua Institutes, notably that of mineralogy and metallurgy (Dr. Wang Tsun-Ming), that of radio physics (Dr. Rjên Chih-Kung), and that of crystal physics (Dr. Yu Shui-Huang, a former collaborator of the Braggs). The first of these co-operates with the Yunnan Geological Survey in assaying the numerous interesting and rich ores newly discovered in the province, and has found new alloys with important thermo-electric properties. The second is occupied with telecommunications, and has complete apparatus for making experimental valves in these rustic surroundings. The third possesses good equipment, all made in Yunnan, such as a Debye-Scherrer

powder crystal camera, Laue oscillating camera, etc. The altitude of Kunming (some 6,000 ft. above sea-level) is so high that the spark-gap setting is affected. These institutes have good workshops, but they would have very much better ones if financial support were available to set up and run some of the machines which were saved from the east or smuggled through the Japanese lines after the fall of Peiping and Hankow. There is also a great difficulty for all scientific institutions here, namely, that the university or Government wage for technical assistants is much smaller than what they can earn by going into business in a time of rise in prices which may truly be called gigantic. I shall have more to say on this subject in the following article.

National Academies

Besides the universities in China there are also two national academies: the Chinese National Academy (Chung Yang Yen Chiu Yuan) and the Peiping Academy (Peiping Yen Chiu Yuan). Of the ten research institutes of the former, three are located in the neighbourhood of Kunming, those of astronomy, chemistry and engineering. The astronomical observatory, exiled, alas, from its beautiful buildings on the Purple Mountain near Nanking, is situated a long way out in another direction from Kunming, at Big Tree Village. One of the members of the staff there is Dr. Tai Wên-Sai of Cambridge, formerly a collaborator of Prof. F. J. M. Stratton. The chemical institute is nearer town, and work is going on there on ultra-violet spectral analysis of organic and inorganic compounds, as well as on the active principles of local drugs, under the direction of Dr. Wu Shioh-Chou. The engineering institute is largely occupied with glass technology and metallurgical problems. Its workshop constructs all kinds of apparatus, such as kymographs and respirometers, for other scientific institutions.

The physics and chemistry sections of the Peiping Academy are located some three hours out, again in another direction, at a beautiful spot in the foothills near White Jade Hill. Here the physics section, under the direction of Dr. Ni Chi-See and Dr. Tsien Ling-Chao, has turned over almost wholly to war production, and a most remarkable plant for grinding lenses for microscopes, telescopes, etc., has been set up. The Academy is actually producing microscopes for teaching and research, having worked out all its own necessary apparatus, such as spherometers, etc. It is dependent on optical glass from England, however. Besides this, entirely new methods have been developed for making quartz piezo-electric crystals for frequency stabilization in radio work, and these are being produced in regular quantity, so that a supply may be available for the other United Nations. A point of interest here is that Dr. Tsien Ling-Chao has worked on the history of science in China, and has studied the optical chapters in the works of the classical Chinese philosopher, Mo-Tze (*c.* 400 B.C.). The Peiping Academy has also a section of chemistry, presided over by Dr. Liu Wei-Tao. Here also work is proceeding on the indigenous anti-malarial drugs by Dr. Wang Hsiu, an Austrian-trained organic chemist, and on the anthraquinone compounds of the rhubarb family.

Central Machine Works

Together with some of the members of the Peiping Academy, I paid a visit to one of the largest engineering works in China, the (State) Central Machine Works, which is established in a mountain valley in Yunnan, and employs thousands of workers. Here it was a remarkable sight to see the elaborate apparatus for making fine tools, gear wheels, and other engineering parts requiring high accuracy, hidden away from the risk of air bombing in tunnels and artificial caves in the hillside. In the depth of the mountain one could see a Chinese skilled worker checking the accuracy of the machining on a Zeiss universal measuring machine in a constant-temperature room. Or one could view a scene resembling the cavern of Hephæstus, except that the ovens were of the most modern gas-filled kind used for tempering machined steel parts. Elsewhere are a vast foundry and assembling shops. There is an impressive system of apprenticeship, with special shops for training the young fitters and machinists. The main output of the factory is primary machinery such as drilling, planing, milling, boring and rolling machines, which are supplied to arsenals and other works, and the finished products, standing in their rows, were very impressive. These works really deserve an article to themselves. The whole is under the direction of an engineer (a former physicist), Dr. Wang Shou-Chin. Dr. Wang's father, Dr. Wang Chi-Tong, now a venerable figure of seventy, is also interesting. Himself the son of a Hanlin scholar, he was one of China's first modern engineers, and is now in his retirement devoting himself to the study of Buddhism in relation to modern thought.

Description of the Central Machine Works affords an opportunity for mentioning one very hopeful sign observable there, namely, the effort on the part of the Chinese to get away from the bad side of their old traditions of scholarly aloofness from manual labour, and the old system of excessive politeness. In these works, fully trained university graduates in engineering are working side by side with the ordinary workers, taking active day-to-day charge of each special process and controlling every stage. This is really a change from the old graduate's attitude to practical work. The same improvement may be seen in the atmosphere at the National Vaccine Production Institute (the National Epidemics Prevention Bureau), directed by Dr. T'ang Fei-Fên. Here once a week, as a kind of communal exercise, all the workers of the Institute, including the medical men, bacteriologists, etc., as well as the glass-makers, the routine fillers and samplers, the stables staff, etc., join together in levelling and improving the site so as to convert it into a healthy garden.

Geology

It only remains to describe a little of the work of the geologists. The geologists of the Associated University (led by Profs. Sun Yuing-Ch'u, a former collaborator of Prof. J. E. Marr at Cambridge, and Yuan Fu-Li) work in close association with the Yunnan Geological and Mineralogical Survey, and together they have investigated large parts of the province. A picturesque old house in the country has been appropriated to the purposes of a museum, and there a very fine collection has been assembled, with separate sections for stratigraphy, ores, palæontology, etc. Yunnan is an area extremely rich in mineral resources, having admirable ores of antimony, arsenic, zinc, copper, iron, cobalt, tungsten and tin, as well as coal, lignite, rocksalt, asbestos and mica. Phosphate deposits are widespread, with phosphorus content as high as 38 per cent.

THE LISTER INSTITUTE OF PREVENTIVE MEDICINE

FIFTY YEARS RESEARCH ACTIVITY

By SIR JOHN LEDINGHAM, C.M.G., F.R.S.

THOUGH the British Institute of Preventive Medicine had received its certificate of incorporation under the Companies' Acts in 1891, it was not until two years later that its amalgamation with the College of State Medicine, with its rooms at 101 Great Russell Street, London, made possible its embarking on the scientific activities it was founded to promote. It is fitting, therefore, that short of celebrating in some more overt fashion, had times been normal, the jubilee of an institution which has well and worthily performed the charge committed to it by its founders, we should at least take the opportunity of recalling its genesis and of reviewing in briefest compass the services it has rendered to preventive medicine throughout a period which has witnessed that branch of science so bountifully enriched by the cultivation of all those basic studies that minister to its advancement.

The genesis of the British Institute of Preventive Medicine is soon told. A Mansion House meeting took place on July 1, 1889, to discuss the urgent problem of hydrophobia in Great Britain in the light of Pasteur's experimental work, and his elaboration of what had been almost universally hailed as a successful method of treating the victims of rabid dogs by immunizing them with his attenuated virus. At this meeting a resolution moved by Victor Horsley that the Government should be invited to introduce a Bill for the simultaneous muzzling of all dogs throughout the British Isles and for enforcing quarantine of imported animals was carried, and a son of Pasteur who attended the meeting was asked to convey to his father the thanks of the meeting for his services to British victims sent to Paris to undergo the new treatment. A committee was appointed to consider the most appropriate manner of discharging their debt to Pasteur and his staff for treating gratuitously "over 200 of our fellowcountrymen". Towards this object an appeal for funds was made, and the result was a gift of some two thousand pounds which was forwarded to Pasteur as a contribution to the Institute which bore his name and which had been formally opened only nine months previously (November 18, 1888). Funds were also raised towards the reimbursement to needy patients of their travel costs to Paris.

This was not all, however. The Committee enlarged its numbers and proceeded to consider how the lack of an institute in Great Britain with similar objectives to those of the Pasteur could be made good; and the final outcome of their deliberations, details of which cannot be given here, was the founding of the British Institute of Preventive Medicine, which received its charter on July 25, 1891. Long before this date, however, steps had been taken to secure sufficient funds to enable a commencement, even in a small way, of the Institute's programme of work. Financial support was solicited from private individuals and City of London companies, but progress was slow and indeed gave the promoters much concern, for provision had to be made not only for a scientific staff but also for the erection of a building worthy of the purpose it was destined to subserve.

Very substantial help came from the Berridge Trust and the Grocers' Company and this, together with private donations and the liquid assets of the College of State Medicine, with which amalgamation was effected in 1893, placed the British Institute of Preventive Medicine in command of invested funds of the order of £60,000, at least half of which was earmarked for building purposes. Temporary accommodation for staff and students was found in rooms at 101 Great Russell Street, the lease of which was taken over from the College of State Medicine, and here the work of the Institute was carried on under very restricted conditions until the move could be made in 1898 to the new building in Chelsea Gardens. On December 6 of that year the British Institute became the Jenner Institute, in fulfilment of a promise by the Council to the Jenner Memorial Committee, which had collected funds to commemorate in some fitting way the centenary of Jenner's great discovery, that such change would be made should the funds collected be placed at the disposal of the Institute. The sum handed over by the Committee amounted to £5,768 and, ever since, the revenue from its investment has been disbursed on behalf of a Jenner Memorial Studentship tenable at the Institute. Five years later, in 1903, constantly recurring difficulties arising from a prior claim to Jenner's name by a body trading as the Jenner Institute of Calf Lymph, necessitated a further change of name and it was decided, with Lister's consent, that the Institute should bear his name.

Since the Mansion House meeting, Lister had taken a leading part with Sir Henry Roscoe in all the difficult and tedious negotiations with Government departments leading to the incorporation of the Institute as an association limited by guarantee but permitted to omit the word "Limited" from its designation. He had publicly upheld the importance of animal experiment in opposition to the noisy objections of the anti-vivisectionists, and he had been president of the Council of the British Institute until that body ceased to exercise executive functions on its replacement by a governing body of seven members under the terms of the munificent gift (1899) of £250,000 to the Institute by Lord Iveagh, whose interest Lister had been largely instrumental in securing. This gift gave an immediate assured income of some £8,000 a year and made possible progress in many directions.

So far I have referred only to the main research building in Chelsea Gardens, but one of the earliest ventures was the organization by the Council of the British Institute of an experimental farm for serum production, particularly diphtheria antitoxin. Dr. M. Armand Ruffer, who was appointed interim director in 1894 after the amalgamation with the College of State Medicine, was able to report to his Council that in August of that year he had immunized one or two horses against diphtheria toxin. These first horses to be immunized in Great Britain were stabled at the Brown Institution, and valuable help with the technical arrangements was given on the spot by Horsley and Sherrington. Later in the year, the work was removed to Sudbury, and finally in 1902 transferred to Elstree, where the Serum Department of the Institute has since been located. This department has not only been of enormous value to the Institute in providing an additional source of income from the sale of biological products, particularly therapeutic sera, but has also proved an unequalled training ground for young members of staff and voluntary workers, native and foreign, eager to

acquire a practical knowledge of immunological principles with the added advantage of working with large animals.

Further Developments

Developments of the Lister Institute since its inception have been concerned almost solely with the growth of departments, and the institution of new departments rendered desirable less by reason of completeness or mere yielding to custom, than by the availability of outstanding exponents to run them. Some departments have had short lives, while others, such as those of nutrition and biophysics, the latter a quite recent innovation, have obviously come to stay in view of their weighty contributions to preventive medicine in the widest sense. It may be of interest to note that in 1919 the Governing Body, then becoming anxious about the future financial state of the Institute in view of increased costs of research and a probable falling-off in trading profits, proposed to the members that the name of the Institute as shown in the articles of association be changed to the "Lister Institute of Medical Research", on the ground that the change would convey to all persons more clearly the nature of the work carried on in the Institute than the words "Preventive Medicine", and that consequently more public support in the form of additions to its permanent revenue might ensue. The motion, however, was lost at an extraordinary general meeting of the members held on June 11, 1919.

The proposal in 1914, by a majority of the Governing Body, to hand over the Institute to the Government, under certain conditions, as a nucleus of the research organization contemplated by the National Health Insurance Act of 1911, created wide interest both internal and external. At a specially called meeting on November 18, 1914, of members of the Institute, Sir Henry Roscoe in the chair, the proposal was keenly debated, the merits and demerits of State control being the main theme expounded by a succession of distinguished speakers. The motion to amalgamate was, however, lost by a narrow margin of votes.

The idea of having a research hospital attached to the Institute, of similar character to those at the Pasteur and Rockefeller Institutes, was *inter alia* considered by a Reconstruction Sub-committee of the Governing Body in 1919, and it was agreed to be a sound one. Steps were accordingly taken with the approval of members at specially called meetings to have the relevant item on treatment in the original memorandum of association altered by the Court to permit the building of an in-patients hospital for which ground adjacent to the Institute was available, provided that, for the establishment and maintenance of such hospital, only funds "as shall be specifically subscribed for that purpose" be employed. So far, the necessary funds for that purpose—and they would require to be very large funds—have not been forthcoming.

The Institute as a Scientific Centre

It is not for me, at least here and now, to traverse, much less to assay, the published work of half a century in a variety of fields. This must await a fuller history. Apart from the two specially printed volumes of dates 1897 and 1899 (London: Macmillan and Co.) containing papers published before the Institute adopted the name of Lister, there have appeared some forty volumes of "Collected Reprints", copies of which have been sent to selected individuals and scientific libraries in Great Britain and abroad. The very titles of the papers in these volumes will, as the years pass, be found to reflect very accurately the kind of problems that have exercised the minds of investigators at different periods, from the earliest activities of bacteriology, chemistry and immunology as the chief handmaidens of preventive medicine, to the advent of other disciplines such as biochemistry and biophysics which have come to the help of, and indeed would sometimes seem to dominate, current advance in fields which hitherto have been cultivated mainly on biological lines. I may mention, for example, bacteriology, immunology, nutritional science, endocrinology and virus structure. It is already clear that future workers in the field of preventive medicine, whatever form their particular biological training may take, will be well advised to add to their armamentarium a good deal more than a mere capacity to appreciate the help that chemistry and biochemistry can give to their problems; *mutatis mutandis*, I may add, for the trained chemist embarking on a biological problem.

Fortunately, in an institute containing experts in various disciplines, the difficulty of ensuring that the fullest light is thrown on a problem is considerably lessened. In the forty-two volumes to which I have alluded appear not only the fruits of inquiries planned within the Institute's walls but also scientific contributions and reports on a great variety of problems in the solution of which Institute workers have from time to time been invited to participate by various Government, public and scientific bodies. I may refer, for example, to such matters as the experimental demonstration of the rat flea as the vector of plague, the new knowledge of caisson disease and cognate issues made possible by the large pressure chamber, the gift of Dr. Ludwig Mond, the work on vitamins and deficiency diseases originally commenced in the middle of the War of 1914–18 to satisfy a crying need for special knowledge to meet an urgent war problem, and now with greatly expanded knowledge serving the present war effort at home and abroad, the investigation of the insect vector question in trypanosomiasis, yellow fever, typhus and trench fevers and many others.

Aside from its research activities, or perhaps because of them, the Institute has from its inception performed a most valuable function in providing research facilities for young workers from Great Britain and other countries desiring to acquire a working knowledge of technical methods, or to undertake under supervision some particular piece of work, holders of Beit and other fellowships, including those attached to the Institute, together with approved young graduates preparing for the higher research degrees of the University of London, with which the Institute has long been affiliated as a research school with its professors, readers and recognized teachers. Many of these former students and many former members of the Institute's staff have afterwards had distinguished scientific careers in academic or other spheres in various parts of the world. Having but recently retired from a lengthy term of service on the Institute's staff, I would wish to send here a friendly greeting to all former Listerians on this important occasion; and to offer, on behalf of NATURE, its congratulations to the Institute's Governing Body and staff, and its best wishes for the future work and welfare of the Institute in a post-war world.

ASCORBIC ACID IN DEHYDRATED FOODS

By DR. L. W. MAPSON

Dunn Nutritional Laboratory, University of Cambridge, and Medical Research Council

THERE is much evidence that titration against 2,6-dichlorophenolindophenol, provided it is done rapidly and in acid solution[1], gives results accurately agreeing with the biological estimate of ascorbic acid in common foodstuffs, including fruits and vegetables (both raw and as generally cooked), and in various animal tissues[2]. Even for most manufactured articles, such as jams, tinned fruits and various other processed foods, the chemical test has been shown to be generally applicable[3]. In a few exceptional instances, however, interferences from non-specific reductants may have to be allowed for. Such substances occur in caramelized and fermented products (for example, in malt extracts, or the products obtained by alkaline-heat treatment of sugars, in materials such as oats or pea mush after heat treatment, and in yeast and fermented juices)[3]. The substances known to interfere include stannous and ferrous salts, as well as sulphites, sulphides and thiosulphates, among inorganic substances, and reductones and reductic acid among organic compounds. Substances of the former class, however, are not normally present in foodstuffs, and moreover they can be fairly easily differentiated if desired. Thus, thiosulphate and sulphydryl compounds may be removed by precipitation with mercuric acetate[4], sulphite by treatment with acetone[5], or sulphides by conversion to hydrogen sulphide and removal *in vacuo*. Lugg[6] has recently recommended the use of formaldehyde to differentiate ascorbic acid from sulphides, sulphites, thiosulphates, quinones, sulphydryl compounds and reductones. It will be recalled that glutathione does not interfere under the conditions of the test[7], and that free cysteine is not normally a constituent of foodstuffs and in any event reacts so much more slowly that its presence would not be a source of serious error.

We became interested in the differentiation of ascorbic acid from reductones and allied compounds when evidence was found of their presence in certain dehydrated foods which had been subjected to heat treatment. These reductones, as would be expected from their chemical structure, resemble ascorbic acid in many ways; they are more stable in acid and less stable in alkaline solution; their oxidation is catalysed by copper and enzymes such as ascorbic acid oxidase; and they give a current-voltage curve on the polarograph so close to that given by ascorbic acid that, in high concentrations, it is difficult to estimate ascorbic acid in their presence. For this reason, we have examined in detail the possibility of using formaldehyde to differentiate between them and ascorbic acid, and have found that if proper precautions are taken this reagent provides a valuable means of making the titration with 2,6-dichlorophenolindophenol a highly specific method for estimating ascorbic acid in the presence of reductone-like substances. As reliable methods for assaying ascorbic acid in dehydrated foods are of topical interest to an increasing number of workers, a preliminary note on a method so far found successful seemed appropriate.

The method used is as follows. The material to be analysed is extracted with sufficient 5 per cent metaphosphoric acid, according to the method recommended by Harris and Olliver[8], to give an extract containing preferably between 0·04 and 0·10 mgm. of ascorbic acid or its equivalent per ml. If the material to be analysed is too poor a source for this to be done, it should be extracted with the minimum of metaphosphoric acid consistent with adequate extraction. The extract should be kept in the dark during the analytical operations.

If the presence of sulphide, sulphite or sulphydryl compounds is suspected, an aliquot portion of the solution is adjusted to *p*H 0·6 by the addition of 50 per cent H_2SO, then HCHO to a concentration of 4 per cent is added and the solution titrated against indophenol dye after standing for 8 min. at 20° C. If no sulphide, sulphite or SH compounds are present, this preliminary treatment may be omitted and the first step is to titrate the metaphosphoric acid extract (*p*H 1·2) directly against indophenol. In either instance, this titre, expressed as ascorbic acid, is the initial value (*A*) for plotting graphically at zero time. (Modifications in the initial treatment have to be carried out if the metaphosphoric acid extract contains substances like dihydroxy maleic acid, or reducing compounds present in malt extracts or beet molasses which are unstable in metaphosphoric acid solutions; for details the reader is referred to the fuller paper in the press.)

A further aliquot of the metaphosphoric acid extract is adjusted to *p*H 2·0 by the addition of sodium citrate solution and HCHO added to a concentration of 8 per cent, and the solution allowed to stand at 20° C. Samples of this solution are withdrawn at intervals of 5–10 min. and immediately brought to a *p*H value of 0·6 by the addition of 50 per cent H_2SO_4 in order to arrest further reaction. These several solutions are titrated against indophenol within 5 min. of taking the sample. It is quicker, and little accuracy is lost, if the samples of solution at *p*H 2·0 mixed with HCHO are titrated directly with indophenol without the addition of H_2SO_4, provided there is no delay and the time interval noted in each instance between the start of the reaction and the moment of titration.

These titrations should be carried out at intervals over a period of 0–90 min. after adding the HCHO, and the values of the indophenol titres, expressed as ascorbic acid, plotted as ordinates, against the times as abscissæ. The line joining the points on the later flat part of the curve so obtained is extrapolated back to the ordinate axis, cutting it at a point *X*. The difference between the initial indophenol titre *A* and the value represented by the point *X* is equivalent to the ascorbic acid content of the extract.

The principle of the procedure is as follows. In the preparatory treatment used in the presence of sulphydryl compounds, the latter are removed by condensation with the formaldehyde but, at the very acid reaction employed, ascorbic acid and reductones remain unaffected. The initial titration *A*, at *p*H 0·6 or 1·2, measures ascorbic acid plus reductones. In the second reaction, in the less acid solution (*p*H 2), the ascorbic acid is completely removed by condensation, while the reductones are only slowly condensed, and their amount can, therefore, be found by extrapolation in the manner described, the ascorbic acid being given by difference.

The method so applied to fresh vegetable and animal tissues, and some typical cooked foods, jams, canned foods, etc., gives results agreeing well with those obtained by the ordinary, direct indophenol titration, but in the special case of certain dehydrated

foods subjected to heat treatment, the ascorbic acid values are found to be lower than those given by the simple titration with indophenol. Although, for example, the ascorbic acid content of freshly dehydrated cabbage, whether determined by direct indophenol titration, by biological test[8], or by the formaldehyde method, is identical, after the dried cabbage has been stored at temperatures in excess of 25° C., there is a gradual production of substances capable of reducing indophenol which resemble reductones in their reaction to formaldehyde. Reductones may also be produced in dehydrated foods if the fresh materials are dried at unduly high temperatures so as to cause even slight scorching of the tissues. For these reasons, it is advisable when estimating ascorbic acid in such materials, or in fermented or caramelized foodstuffs in general, to employ a method which will differentiate between it and reductones, or reductone-like substances. Full experimental details of the method, and an account of the results, will be published shortly.

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APPARENT VITAMIN C IN CERTAIN FOODSTUFFS

By DR. FRANK WOKES, JOAN G. ORGAN, JEANETTE DUNCAN AND DR. F. C. JACOBY

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A NUMBER of previous workers[1,2,3] have reported the occurrence of non-specific indophenol-reducing substances in certain fermented or heated foodstuffs. Investigations in our laboratories during the last two years have confirmed these earlier findings and extended them to a wider variety of materials, while showing that the interfering substances may be produced under much less drastic conditions than was previously thought possible. The term 'apparent vitamin C' is suggested as conveniently describing these substances which differ from interfering substances previously studied (such as sulphites, glutathione) in simulating vitamin C so closely in their chemical and physical properties that they cannot be distinguished from it by the assay methods which have so far been generally employed. It is probable that, in contrast with sulphites, glutathione, etc., they also resemble vitamin C closely in chemical constitution.

In 1941, during experiments on the production of vitamin C in germinating grains (wheat, barley and oats) using the dye 2 : 6-dichlorophenolindophenol to estimate ascorbic acid, it was found that the apparent vitamin C content could be considerably increased by heating the germinated grains with water containing 1 or 2 per cent of concentrated hydrochloric acid, dye titration figures becoming steadily larger as heating continued. At *p*H 4·5–5·0 in absence of mineral acid, the production of the apparent vitamin C in extracts of these grains took place equally rapidly at 100° C., and still occurred more slowly at lower temperatures down to 5 or 6° C. Its rate of production is also affected by the moisture content, being almost completely inhibited by reducing this to 1 or 2 per cent. The apparent vitamin C thus obtained resembles ascorbic acid in many of its properties, being rapidly destroyed by oxidase from cabbage leaves or tomato skins, by shaking with charcoal in air and by very low concentrations of hydrogen peroxide (1 in 10^5) or of percarbonate (1 in 10^4), but has not the physiological properties of vitamin C. It has been found in a variety of food products, including fruit syrups, cocoa, malt extract, dehydrated fruits and vegetables and cane and beet molasses; also in a number of samples of beer. Concentrated preparations have been obtained with an apparent vitamin C content of 200–300 mgm. per 100 gm., but no physiological activity as shown by biological tests. Spectroscopic examination of some of these preparations by Dr. R. A. Morton showed absorption maxima at 256–264 mμ, and 275–280 mμ, suggesting the presence of reductic acid first described by Reichstein and Oppenaeur[4] and possibly of dihydroxymaleic acid (*vide* S. Györgyi[5]) or of oxytetronic acid (*vide* Mohler and Lohr[6]). Attempts to extract dye reductants from these concentrated preparations by shaking or heating in a soxhlet with methanol or ethanol or by prolonged shaking of the aqueous extracts with ether have so far failed.

During the last two years we have experimented with various methods of estimating ascorbic acid in the presence of these non-specific dye-reducing substances, based on various properties such as their stability towards heat and instability towards acid in dilute aqueous solution. By such methods we discovered that the development of apparent vitamin C in certain foods during processing involving heat, or during storage, may lead to dye titrations giving false impressions of the vitamin content and its stability. In December 1942, learning from Dr. Mapson that he was working on a similar problem in dehydrated foods, we interchanged results with him, and at his suggestion explored the possibility of estimating true vitamin C in our experimental materials by condensation with formaldehyde as proposed by Lugg[7].

Mapson[8] has investigated the formaldehyde method thoroughly. He obtains the best results at a *p*H of about 2. However, the interfering substances with which he has been mainly working are probably of the nature of reductones such as Norrish and Griffiths[9] obtained by heating various carbohydrates with alkali. Spectroscopic evidence indicates that changes take place in reductones when *p*H is below 6. Our apparent vitamin C, which is produced at a *p*H below 5, and in some instances so low as 1, differs from reductones in being unstable in metaphosphoric acid solutions, and in being more readily distinguished from true vitamin C by condensation with formaldehyde at *p*H 4–5 than at *p*H 2. At *p*H 4–5, formaldehyde reacts with only a small fraction (usually 5–10 per cent) of the interfering substances while destroying the whole of the true ascorbic acid. The total apparent vitamin C in the preparation is first estimated by the potentiometric method of Harris, Mapson and Wang[10], particular care being taken with the precise timing and rate of addition of dye as mentioned by Wokes *et al.*[11]. The true ascorbic acid is then destroyed by six minutes treatment with 6 per cent of formaldehyde at *p*H 4–5 and room temperature, and apparent ascorbic acid again estimated. The difference between the two results, corrected for the small amount of interfering sub-

stance which has also condensed with the formaldehyde, indicates the true vitamin C content. In all determinations of apparent vitamin C the metaphosphoric acid extracts should be stabilized with nitrogen as soon as they are made. The above method has given satisfactory results with mixtures of true ascorbic acid with the interfering substances in widely different proportions, duplicates agreeing within the limits of experimental error of the potentiometric method, which we found more suitable for many of our coloured products than the visual method used by Mapson.

Apparent vitamin C has not yet been found in *fresh* fruits and vegetables, although we have reason to believe that it is not entirely absent from the vegetable kingdom. Hochberg, Melnick and Oser[12] have recently reported some interesting findings on *dried* tomatoes and potatoes which we also have been studying. Using a photometric method of estimating vitamin C in which the rate of decolorization of the dye is followed by readings taken every five seconds, they find that on storage there is progressive formation of dye-reducing substances which in visual titrations react slowly, thus giving too high results. They appear to think that this apparent vitamin C which gradually develops may contain dehydroascorbic acid as well as other non-specific dye-reductants. They claim that their method is much more specific for true ascorbic acid, allowing determinations to be made in the presence of relatively large amounts of other substances which reduce the dye. We have followed by means of E.M.F. changes the rate of reaction of true and of apparent vitamin C with the dye in many estimations during the last eighteen months, and agree that the non-specific substances reduce the dye more slowly than ascorbic acid does. In contrast with the above authors, we find the reaction of the dye with ascorbic acid to be completed in less than two seconds, even with much higher concentrations of ascorbic acid than they employed, while the reaction with dihydroxymaleic acid and other constituents of apparent vitamin C may require more than a minute for its completion. We consider this method of estimating true vitamin C in the presence of apparent vitamin C to be less accurate than the formaldehyde method, either used visually as described by Mapson or (when this is not applicable) used potentiometrically as described above.

We are indebted to Dr. L. J. Harris and his colleagues for advice and criticism, to Dr. R. A. Morton for spectroscopic examination of various samples, and to Mr. H. C. Powers, chief chemist, Messrs. Tate and Lyle's Thames Refinery, for samples of molasses.

Details of this investigation will be published elsewhere.

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OBITUARIES

Prof. Charles Schuchert

THE death of Prof. Charles Schuchert, which occurred on November 20, 1942, removes an eminent American stratigrapher and palæogeographer, who was also a leading authority on brachiopods. Born at Cincinnati on July 3, 1858, he was early attracted by the richness in fossils of the rocks surrounding his home; and although he received only a primary school education, which ceased when he was fourteen, he made such good use of his opportunities of collecting that he attracted the attention of the great American palæontologists of the period. In 1885 he was given employment as assistant in palæontology to E. O. Ulrich, and later he worked in turn with James Hall and with C. E. Beecher. He worked in connexion with the Geological Survey of Minnesota, and in 1893 became assistant palæontologist to the United States Geological Survey. In 1894 he was appointed assistant curator in palæontology at the United States National Museum, where he remained for the next ten years, having opportunities during this period to collect in Europe, Greenland and Canada. In 1904, at Yale University, he became concurrently professor of palæontology, professor of historical geology in the Sheffield Scientific School, and curator of the geological collections at the Peabody Museum. He remained at Yale for the rest of his life, receiving the title of professor emeritus on his retirement in 1926, and of director emeritus of the Peabody Museum on his eightieth birthday. He received honours from various universities and learned societies; he was president of the Geological Society of America in 1922, and was elected foreign correspondent of the Geological Society of London in 1927 and foreign fellow in 1929.

Schuchert's published books, papers and articles amounted in all to between two and three hundred items, their subjects including stratigraphy and palæogeography, primarily of America, systematic palæontology, and scientific biography. His interests covered the whole geological column, but he concentrated especially on the Palæozoic. Together first with Pirrson and then with Dunbar, he published "A Text-book of Geology", being himself responsible for the section on historical geology; and in 1927 appeared a book intended for the layman, "The Earth and its Rhythms", written jointly with Clara M. LeVene.

In the field of palæontology, he worked principally on the Brachiopoda, although members of other groups, especially of the Echinodermata, also claimed his attention. About 1902, he presented his collection of fossils, including ten thousand brachiopods, to the United States National Museum, but he made a further collection of some hundred thousand specimens of brachiopods which he bequeathed to Yale.

His knowledge of the brachiopods was wide and deep. He published many papers on their systematics, including in 1932 a monograph of the Orthoidea and Pentameroidea written in collaboration with G. A. Cooper. Perhaps, however, the greatest significance of his work lies in the fact that he was the earliest author to produce a general conspectus of the group following on the pioneer work of Davidson, Hall and Clarke, and the other great 'brachiopodists' of the later nineteenth century. In 1897, Schuchert published "A Synopsis of American Fossil Brachiopoda including Bibliography and Synonymy", which has remained a standard work, containing a sound

discussion of the evolution of the group. Later he undertook in Zittel-Eastman's "Text-book of Paleontology" the section on brachiopods, which again is indispensable as a work of reference. In 1929, together with Clara M. LeVene, Schuchert produced the brachiopod section of the "Fossilium Catalogus", an invaluable index of genera and genotypes, newly classified.

Schuchert's combination of detailed knowledge of the brachiopods with a wide and inclusive outlook on palæontology enabled him to recognize systematic differences but yet at the same time to avoid excessive 'splitting', while producing an orderly classification from a chaotic group. The outcome of long-continued thought and consideration, his studies revealed with complementary clarity the nature both of the component individuals and of the group as a whole.

MURIEL A. ARBER.

WE regret to announce the following deaths:

Prof. William M. Esten, emeritus professor of bacteriology in the University of Connecticut, on April 16, aged eighty.

Dr. K. Landsteiner, For.Mem.R.S., of the Rockefeller Institute for Medical Research, on June 26, aged seventy-five.

Prof. Garfield Powell, assistant professor of chemistry in Columbia University, aged forty-nine.

Dr. Mary J. Rathbun, honorary associate in zoology of the U.S. National Museum, on April 4, aged eighty-two.

Prof. W. A. Setchell, emeritus professor of botany in the University of California at Berkeley, on April 5, aged seventy-eight.

Prof. William C. Walker, professor of chemistry in McMaster University, Canada, on March 30.

NEWS and VIEWS

Industrial Research in Great Britain

SIR EDWARD APPLETON, secretary of the Department of Scientific and Industrial Research, in opening the new physico-chemical laboratories of the British Coal Utilization Research Association at Coombe Springs on June 23, congratulated the Association both on its new facilities in laboratory space and on the financial provision now available for large-scale work. The steps the Association has taken are among the first notable signs of a great forward movement in industrial research in Great Britain, Sir Edward said, which he confidently expects will be one of the features of post-war Britain. The Coal Utilization Research Association is serving the coal industry as a whole, and he particularly welcomed the expression of the interest of the miners themselves shown in the recent appointment of two members of the Mine-workers' Federation to the council of the Association. It is, he said, fashionable nowadays to decry British industrial research effort, because it is claimed that the amount of money spent on research per head of population is less than that in certain other countries. Much depends, of course, on what basis such a calculation is founded; whether or not, for example, development costs are included under the heading of research. Moreover, there can be unwise expenditure, as well as wise expenditure, even on research. But it can certainly be stated that British effort on research is not commensurate with our industrial needs. To talk merely of spending more money, however, was not enough. It was necessary to plan our attack on both new and old problems and, most important of all, to attract some of our best scientific brains in the country to solve them.

It has also been stated that, whereas Great Britain has, in the past, been responsible for many of the most fundamental discoveries in science, other countries have often been the first to apply them to practical ends. Sir Edward said that he could safely predict that when the full story can be told after the War, our work in the application of science, as distinct from the accumulation of scientific facts, will be found second to none. He instanced the example of one of the most striking of our war-time developments, namely, that of radio-location, which was not, as is commonly supposed, a new invention. Here a technique developed for purely scientific ends has been magnificently applied by young British scientific workers to practical war-time uses. In this and other fields it has been amply demonstrated that the young men of Great Britain can hold their own in bridging the gap between laboratory science and its useful expression in appliances and industrial processes.

National Academy of Peiping

A REPORT of the National Academy of Peiping covering the years 1937–42 has been issued by the Kunming Office of the Academy. On the outbreak of the present war with Japan, Peiping was immediately taken over by the invader, and the Academy, which at its foundation in 1929 consisted of nine separate research institutes with a staff of more than two hundred, succeeded in transferring part of the books and equipment of each of its institutes to the south; within a few months most of its work was resumed at Kunming, Yunnan, with a staff now consisting of 120 members. In addition to Chinese Government grants amounting to 620,000 dollars, grants are received from the Sino-American, Sino-British and Sino-French Foundation Funds. The Institute of Physics has been increasingly concerned with problems of industry and national defence. A laboratory for spectroscopy has been established to meet the needs of the new metallurgical industry, and the Institute has also standardized more than a thousand radio transmitters with its own quartz oscillators. Its other efforts have been confined mainly to the development of applied optics and geophysical prospecting. The Institute of Radium consists of laboratories for chemistry and radioactivity, in which many Chinese minerals have been examined, and for X-rays, where the work has been mainly on crystal analysis and X-ray studies of alloys of tungsten and antimony.

In the Institute of Chemistry, work has been carried out on the extraction of dyes from local plants and their application to textiles, the preparation and small-scale manufacture of medicinals from local raw materials, the recovery of used engine oils, replacement of Diesel oil by vegetable oil and preparation of a substitute for petrol from molasses and sawdust, analysis of water supplies and extraction of potash from different types of ashes. The Institute of

Materia Medica has concentrated on investigations of Chinese drugs, such as Chinese ephedra. The active principles have been isolated, and their properties and pharmacological action studied. Some materials such as ephedrin and vitamin B_1 have been prepared on a commercial scale for clinical use. The Institute of Physiology has extended its investigations on the physiological effects of various Chinese drugs to investigations on the nutrition values of the foodstuffs used by inhabitants of the south-west of China, and the treatment of Chicken cholera with sulphanilamide. The Institute of Zoology, besides work on the fauna of Yunnan, has made systematic studies of the principal freshwater fauna of Yunnan, particularly the fishes of the inland lakes, their diseases and enemies. The Institute of Botany has commenced investigations on economic botany, in addition to those on agriculture and forestry already in progress, and a special survey of the plant life of north-west China has been planned and organized. The Institute of Geology is mainly occupied with the detailed mapping of mineral deposits (see also p. 9 of this issue of NATURE).

Earthquake in Turkey

ON June 20, following foreshocks during the previous night to the accompaniment of torrential rain, a severe earthquake shook the beautiful, rich, fruit-growing district just to the east of the Gulf of Ismid, on either side of the Istanbul-Ankara Railway about sixty miles east of Istanbul. The epicentre of the shock was near, and probably just east of, the town of Adapazar, where most of the buildings were wholly or partly wrecked. Other towns more or less damaged in the district were Geyve, Arefie and Hendick, the latter twenty miles east of Adapazar. Nearly all the villages in the district suffered. The shock was felt severely in Istanbul, where some apprehension was caused by walls collapsing. The Constantine Pillar in old Istanbul, dating from the first half of the fourth century, is reported to have been damaged.

Adapazar is a town of some 20,000 inhabitants, and it is fortunate that most of the people there and in the surrounding districts were out of doors, otherwise the death-roll would have been higher than the present estimate of 2,000. Telephone and rail communication broke down so that full information is not yet available, but it is known that the bulk of the population is now living in tents in the fields and orchards of the district. A strong shock was recorded at Stonyhurst College Observatory, near Blackburn (Rev. J. P. Rowland, *S.J.*), at 15h. 38m. 26s., and another at 17h. 59m. 18s., both probably from the Turkish focus. The shock, therefore, probably took place about 15h. 32·8m. and the aftershock about 17h. 53·7m. Help has been sent to the stricken area from Ismid, Bolu and Istanbul, and further information from the district is awaited. The last serious earthquake in Turkey was some six months ago, though the country, particularly that part to the east of the present disturbance, has never been free from recurrent small shocks since the great Turkish earthquake of December 27, 1939 (NATURE, 145, 13; 1940).

Wellcome Research Institution

FREQUENT inquiries are being received, both from this country and abroad, with regard to the two Wellcome Museums. They are, and will continue to be, housed in the Wellcome Research Institution, 183–193 Euston Road, N.W.1. Although the Wellcome Research Institution building suffered considerable damage by enemy action, its structure was unharmed and the Museums can quickly be put into shape again as soon as labour and materials become available after the War. While some of the objects in the Wellcome Historical Medical Museum were damaged, it has been possible to replace or repair most of them. Fortunately, the specimens and other valuable material in the Wellcome Museum of Medical Science remained comparatively intact.

Both Museums are now under the directorship of Dr. S. H. Daukes. A comprehensive scheme for the Wellcome Historical Medical Museum has been prepared and will be brought to completion as speedily as possible after the cessation of hostilities. The Wellcome Medical Library, comprising more than 150,000 volumes, will also be in the same building, and suitable accommodation will be provided for research workers so that both the library and collections may be readily available. The Wellcome Museum of Medical Science—which in the past has been much used by teachers, students and those engaged in post-graduate studies—will be re-established in its entirety at the end of the War with the utmost possible speed. The large lecture hall will be fully re-equipped, including film projection apparatus, and will then be available for scientific lectures and meetings.

Local Industrial Health Advisory Councils

SHORTAGE of medical personnel makes it impossible to satisfy the need for an industrial health service at all fully at the present time in Great Britain, but in every area there are individuals who have sufficient knowledge and experience to give very material assistance in solving local problems. The workers themselves are beginning to take an active interest in measures to promote safety and health, and in some factories safety and/or health committees have already been set up. One of the difficulties that faces these committees in factories where no medical officer is available is how to obtain professional and technical advice in dealing with their problems. Advice on points to note that are particularly valuable as indications of general health trends can also be well used by interested workers. The Leicester Branch of the Socialist Medical Association has endeavoured to bridge this gap in the following way. First, a meeting of workers' representatives was called and an outline given to them of the problem as seen from the point of view of medical and allied personnel. At this meeting, considerable information was obtained regarding health conditions in local factories, and questionnaires were distributed so that further details might be submitted and collated. A second meeting was then held, this time for health workers—medical men, nurses, social workers, welfare officers, etc.—and the information received in the questionnaires was put before them. Arising out of this meeting, a local industrial health advisory council has been set up, through which it is hoped that specialist advice on industrial health matters will be available wherever it is required. There is also, of course, the Central Council for Health Education (Tavistock House, Tavistock Square, London, W.C.2), which has considerable facilities and offers help and advice on industrial and other health problems.

Astronomy in Ships' Names

A NUMBER of Victory Ships recently launched from the slips of the California Shipbuilding Corporation at Wilmington, California, have been named after astronomers. Ship No. 125 of the corporation's war-time programme, the s.s. *George E. Hale*, was launched on January 19 last after only 27 days on the ways, and commemorates the inventor of the spectroheliograph and spectrohelioscope, founder of the *Astrophysical Journal*, and constructional genius mainly responsible for the design and erection of the world's largest refracting and reflecting telescopes at Yerkes and Mt. Wilson respectively. The s.s. *Maria Mitchell*, vessel No. 147, takes her name from the professor of astronomy at Vassar College, who discovered a comet and who was the first of her sex to be elected a member of the American Academy of Arts and Sciences. Ship No. 158, the s.s. *Simon Newcomb*, launched on March 26, is named after the famous superintendent of the American Nautical Almanac Office, who was commissioned professor of mathematics in the U.S. Navy by Abraham Lincoln and who did perhaps more than any other man to popularize astronomy in the United States.

Tank-breeding Mosquitoes in Portsmouth

MR. JOHN F. MARSHALL of the British Mosquito Control Institute at Hayling Island, Hants, has recently issued a pamphlet on the above subject. It deals with the incidence of mosquitoes in static water tanks in the Portsmouth City area. Viewed as a whole, it appears that size of tank is an important factor since the occurrence of mosquito breeding becomes more and more unlikely as capacities increase above the 10,000 gallon limit. Tanks of 5,000 gallons and 10,000 gallons capacities (the two smallest employed) provided one half of the total cases of the occurrence of mosquitoes in some stage of development. In none of these examples was the water heavily infested: in all the larger tanks or sumps mosquito larvæ, when present, were few and far between. The only species of mosquitoes found breeding in the water-containers were *Culex pipiens* and *Anopheles maculipennis*, although many other kinds prevail in the district. On each occasion upon which mosquito breeding was observed, notification was sent to the National Fire Service authorities, who forthwith sprayed the infested water with oil and/or cleared it of algal growths. The success of these operations was evidenced by the fact that with only one exception no tank was found to be mosquito-infested more than once during the whole period considered (April–November).

New Zealand Earthquakes

ACCORDING to the seismological bulletin just received from the Dominion Observatory, Wellington, New Zealand, nine large earthquakes were registered during February 1943 by the seismographs at Auckland, Arapuni, Christchurch, Tuai and Wellington (Dept. of Scientific and Industrial Research, New Zealand Seismological Report, Provisional Bulletin No. P-132, February 1943, Dominion Observatory, Wellington, N.Z.). Additionally during the month twenty-seven shocks were felt in New Zealand. Three of these attained intensity VI on the modified Mercalli scale. The first, on February 17, occurred at 02h. 15·2m. U.T. and was felt in the South Island, south of Buller and Canterbury, with intensity rather greater than VI. The second on February 17, at 13h. 52m. U.T., was again felt in the southern part of South Island with intensity VI. The third on February 25 at 13h. 33·5m. U.T. was felt from Taumarunui and Napier to Hokitika and Akaroa with intensity VI. One shock had intensity V. It was on February 20 at 01h. 48·4m. U.T. and felt in the neighbourhood of Te Anau. Four shocks were felt with intensity IV and the remainder had lesser intensities.

Occultation of Venus

MR. M. A. ELLISON writes: "Permit me to correct and also to amplify the statement of planetary conjunctions given under 'The Night Sky in July' in NATURE of June 26, p. 724. These are described both as conjunctions and as occultations: in fact it is only the conjunction of Venus which leads to an occultation visible in the British Isles. This daylight occultation (disappearance July 6 at 15h. 45m. for Greenwich) is of special interest by reason of the great brilliancy of the planet, which should render it an object easily visible to the unaided eye. The moon will be slightly west of the meridian at an altitude of about 50°. There follows, within half an hour, the occultation of α Leonis, a double event observable with a 2-in. telescope".

Announcements

IF circumstances permit, the Trustees of the Lady Tata Memorial Fund will make the following awards for research in blood diseases, with special reference to leukæmia, in the academic year beginning on October 1: *Grants for research expenses:* Dr. J. Furth (New York); Dr. P. A. Gorer (London); Dr. A. H. T. Robb-Smith (Oxford); Prof. L. Doljanski (Jerusalem). *Part-time personal grant and grants for assistance and research expenses:* Dr. W. Jacobson (Cambridge).

THE following appointments and promotions have recently been made in the Colonial Service: G. A. Walton to be medical entomologist, Sierra Leone; E. Lawrence, agricultural officer, Nyasaland, to be senior agricultural officer, Nyasaland; W. E. Calton, laboratory assistant, Tanganyika Territory, to be assistant Government analyst, Tanganyika Territory; G. S. Brown, L. F. Higgens, L. Leslie Moore and W. S. Warne, agricultural assistants, Tanganyika Territory, to be senior agricultural assistants, Tanganyika Territory.

"RECOGNITION of Decay and Insect Damage in Timbers for Aircraft and other Purposes" is the title of a bulletin issued by the Department of Scientific and Industrial Research. It deals in the main with information for the use of timber inspectors and lists certain timbers in general use, with notes on their resistance to insect attack and decay. In its eighteen pages it deals with those defects and blemishes which occur most commonly in woods ordinarily used in the construction of aircraft and airscrews. The present shortage of timber has made it important to use it economically, and home-grown woods have been called on to make good the diminution of imports. The pamphlet is obtainable from H.M. Stationery Office or through any bookseller, price 6*d*. net.

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

Thermal Scattering of X-Rays by Crystals

THE influence of the thermal vibrations on the diffraction of X-rays by a crystal can be represented by a distribution of scattering power in the reciprocal lattice. The theoretical formula for this is the product of two parts: one, consisting of slowly varying factors which correspond to the atomic scattering factor, the polarization factor, Debye's temperature factor, the Lorentz factor, of Laue-Bragg scattering; the other part consisting of a function characteristic of the dynamics of the crystal vibrations, the diffusion factor $d(Q)$. For a simple lattice the latter has the form

$$d(Q) = \sum_{\alpha,\beta=1}^{3} S_{\alpha\beta}(Q)\, Q_\alpha Q_\beta, \quad . \quad . \quad (1)$$

where Q_1, Q_2, Q_3 are the co-ordinates in the reciprocal lattice, and $S_{\alpha\beta}(Q)$ are the elements of the scattering matrix S, periodic functions of the Q. S can be expressed as a function of the dynamical matrix D, which is defined in terms of the coefficient matrix of the second order terms of the potential energy of the lattice. At normal temperatures one has, with a high degree of accuracy,

$$S = kTD^{-1}. \quad . \quad . \quad . \quad . \quad . \quad (2)$$

The elements of $D(Q)$ have zeros in the reciprocal lattice points, hence those of $S(Q)$ have sharp peaks there. In the neighbourhood of these, they can be expressed in terms of the elastic constants of the crystal. In this way Jahn has calculated[1] surfaces of isodiffusion for sodium, and Mrs. Lonsdale and Mr. Smith have shown[2] that the results are in good agreement with observations.

Since the experiments show, for many materials, a definite structure of scattering power ('streamers' or 'bridges') in the space between the lattice points, it seemed desirable to have a method of calculating the matrix $S(Q)$ for any point of the reciprocal space. This can be done in two ways: either by using numerical calculations of the matrix D as published by Iona[3] for potassium chloride, and by Kellermann[4] for sodium chloride, or by using a crystal model for which D can be theoretically constructed. We have applied both methods. But as Iona's tables are rather rough, containing only four points on each edge of the elementary cube in the Q-space, the resulting figure for $d(Q)$ does not show much interesting detail; it is not worth while reproducing it here.

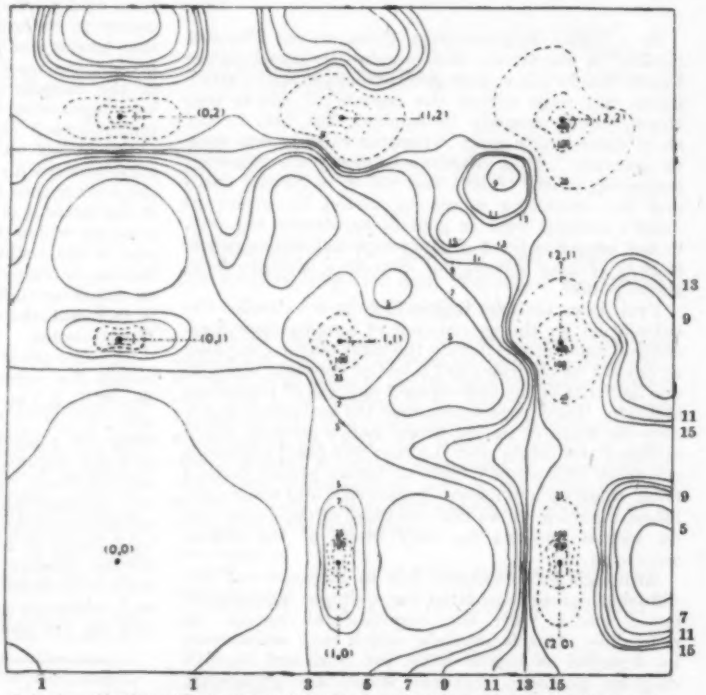
We have therefore developed the second method, taking as the model a face-centred cubic lattice in which only next neighbours act on one another, but with non-central forces. It can be shown that in this case there are exactly three force constants, which can be expressed in terms of the three elastic constants c_{11}, c_{12}, c_{44}. The typical elements of D are

$$D_{11} = (2c_{44} - c_{11})(1 - \cos Q_2 \cos Q_3) + c_{11}(2 - \cos Q_1 \cos Q_2 - \cos Q_1 \cos Q_3),$$

$$D_{23} = (c_{12} + c_{44}) \sin Q_2 \sin Q_3,$$

which for small Q go over, of course, into the expressions used by Jahn. We have in particular considered the plane $Q_3 = 0$, for which case it is not too tedious to form the reciprocal matrix D^{-1}.

In order to compare the results with the first method mentioned above, we took the constants c_{11}, c_{12}, c_{44} as those of potassium chloride, although this lattice is neither monatomic nor simple face-centred. Calculations for metallic crystals satisfying these conditions will be performed later.



Potassium chloride isodiffusion lines in the plane $Q_3 = 0$ of the reciprocal space (Q_1, Q_2, Q_3). The figures attached to the lines are the values of $d(Q)/kT$ if the elastic constants are made dimensionless by dividing them by $e^2/a^4 = 2{\cdot}40 \times 10^{11}$ dyne cm.$^{-2}$ (e is charge of the electron, a is lattice constant, 3·14 A.). The bracketed figures are the indices of the reciprocal lattice points, referred to crystal axes the lengths of which are one half those of the face-centred unit cell.

We computed the elements of D^{-1} and from this the diffusion function (1) for a sufficiently fine network of points. With the help of graphical interpolation, curves of isodiffusion were constructed which are given in the accompanying figure. This comprises nine reciprocal lattice points including the origin (marked by dots). In the vicinity of each of these (except the origin) one recognizes contours of the type found by Jahn. But one sees that the background has a definite and complicated structure; for example, secondary maxima (labelled 15). A remarkable feature is the existence of isodiffusion lines (intensities of 3 and 15, in our scale), forming almost squares which separate the whole field into

unconnected sections. We hope that figures of this kind will provide additional evidence for the thermal theory of X-ray scattering.

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M. BORN.

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[1] Jahn, H. A., *Proc. Roy. Soc.*, A, **178**, 320; **180**, 476 (1942).
[2] Lonsdale, K., and Smith, H., NATURE, **148**, 628 (1941); **149**, 21 (1942). Jahn, H. A., and Lonsdale, K., *Phys. Rev.*, **61**, 375 (1942). Lonsdale, K., *Proc. Phys. Soc.*, **54**, 335 (1942).
[3] Iona, M., *Phys. Rev.*, **60**, 822 (1942).
[4] Kellermann, W., *Phil. Trans. Roy. Soc.*, A, **238**, 513 (1940).

IN a recent lecture-survey given to the Physical Society[1] it was shown that calculations based on the Faxén-Waller theory gave good agreement with experiment, not only within the regions to which that theory could properly be applied, but also in the short wave-length range where its validity was open to question. Thus diagrams showing the observed scattering power of KCl and Na in reciprocal space and the scattering power calculated by means of Jahn's formula were in general agreement not only in the neighbourhood of the reciprocal lattice points (region of long waves) but also at a distance from those points.

Prof. Born and Mr. Begbie have now extended the calculation for the special case of a monatomic face-centred cubic model having the same elastic constants as potassium chloride, and a lattice constant equal to one half that of the face-centred unit cell of potassium chloride. They have determined the scattering power over the whole of the reciprocal lattice network which includes the origin and the first five $\{hk0\}$ reflexions (together with other reciprocal lattice points derived from these by symmetry operations), and their published diagram shows that contours of the Jahn type do indeed account for very much of the diffuse scattering.

Although it is scarcely fair to compare the iso-diffusion curves calculated for a simple face-centred cubic model with the experimental results for potassium chloride crystals, which may more truly be regarded as simple cubic, yet Born and Begbie's diagram possesses features which are apparently typical of the observed data for both potassium and sodium chloride. For example, Laval's ionization spectrometer measurements[2], which showed that the 200 and 220 domains ((1,0) and (1,1) in the above diagram) were completely surrounded by regions of weak scattering, but that between 400 and 420 ((2,0) and (2,1)) and still more between 600 and 620, there were 'bridges' of strong scattering, are now seen to be consistent with the theoretical predictions. It may be of interest to mention that the observed value of the scattering power at the middle of the 600–620 bridge is about 3·4 times the minimum scattering power appropriate to this angle, Compton scattering being subtracted from both observed figures. Inclusive of Compton scattering, the ratio is about 2·2 : 1.

Born and Begbie have commented upon the appearance of isodiffusion lines forming squares the sides of which are parallel to [100] [010]. Almost equally striking are the presence of other lines parallel to the diagonals [110] [1$\bar{1}$0]. 'Bridges' of both these kinds are clearly to be seen on the beautiful monochromatic photograph of sodium chloride published by Gregg and Gingrich[3].

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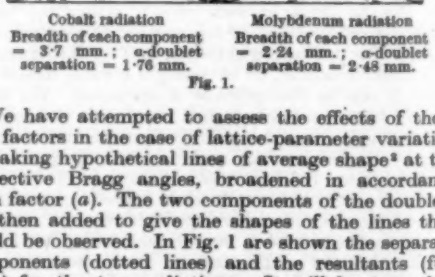
[1] Lonsdale, K., *Proc. Phys. Soc.*, **54**, 314 (1942).
[2] Laval, J., *Bull. Soc. Franç. Min.*, **62**, 137 (1939).
[3] Gregg, R. Q., and Gingrich, N. S., *Phys. Rev.*, **59**, 619 (1941).

New X-Ray Evidence of the Nature of the Structural Changes in Cold-worked Metals

IN a recent issue of NATURE[1] W. A. Wood has published two interesting back-reflexion photographs from cold-worked steel, taken in the course of experiments to determine the nature of the deformation that causes the broadening of the X-ray lines. Such broadening may be caused both by the breakdown of the metallic grains into smaller crystallites and by variation of the lattice parameter from point to point in each crystal grain.

Dr. Wood compares the high-angle reflexions of molybdenum $K\alpha$ (0·7 A.) and cobalt $K\alpha$ (1·8 A.). In the former case the α-doublet is clearly resolved and in the latter it is not; Dr. Wood claims that this is a criterion which definitely shows that small crystallite size is the major cause of line broadening. Many factors, however, contribute to the broadening, and we consider that if they are all taken into account in this case the evidence is not so conclusive as Dr. Wood claims.

The two photographs show (1) line 10 (3 1 0) with cobalt $K\alpha$ radiation ($\lambda = 1{\cdot}79$ A., $\theta = 81{\cdot}1°$); (2) line 62 (7 3 2 and 6 5 1) with molybdenum $K\alpha$ radiation ($\lambda = 0{\cdot}71$ A., $\theta = 77{\cdot}7°$). (The θ values are those for a pure carbon steel; Dr. Wood does not give the composition of his specimen, but the angles are not likely to vary greatly.) In comparing these two photographs it must be borne in mind that (*a*) the breadths of the molybdenum lines will be less by a factor of 2/3 because of the lower Bragg angle; (*b*) the relative separation of the molybdenum $K\alpha$ doublet is three times that of the cobalt $K\alpha$ doublet, and this leads to a ratio of two in the actual separation on the films.



Cobalt radiation
Breadth of each component = 3·7 mm.; α-doublet separation = 1·76 mm.

Molybdenum radiation
Breadth of each component = 2·24 mm.; α-doublet separation = 2·48 mm.

Fig. 1.

We have attempted to assess the effects of these two factors in the case of lattice-parameter variation by taking hypothetical lines of average shape[2] at the respective Bragg angles, broadened in accordance with factor (*a*). The two components of the doublets are then added to give the shapes of the lines that would be observed. In Fig. 1 are shown the separate components (dotted lines) and the resultants (full lines) for the two radiations. It will be seen that

Specimen and radiation	Breadth (mm.)	Doublet separation (mm.)	Corrected breadth (mm.)	β (mm.)	θ	$\lambda R/\beta\cos\theta$ (cm.)	$\beta\cot\theta/R$
Cold-worked, Co	3·64	1·26	3·17	2·70	81·1°	$1·93 \times 10^{-4}$	0·0094
Annealed, Co	1·31		0·88				
Cold-worked, Mo	3·25	2·48	2·24	1·84	77·7°	$0·82 \times 10^{-4}$	0·0089
Annealed, Mo	1·04		0·69				

for cobalt $K\alpha$ one broad line is formed, but for molybdenum $K\alpha$ there are still two resolved lines; we doubt whether the difference between this result and the one that Dr. Wood shows photographically can be distinguished by eye.

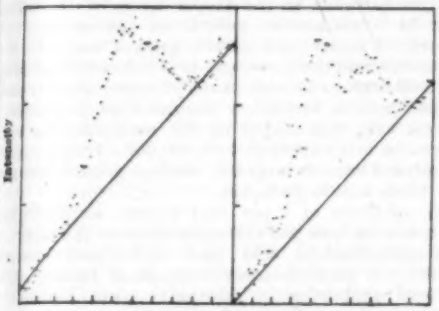


Fig. 2.

In order to examine the effect experimentally, we have taken X-ray photographs of iron filings in a camera of radius (R) 4·5 cm. with molybdenum $K\alpha$ and cobalt $K\alpha$ radiations and have made measurements on the highest spectra in each case. Photometer curves were obtained for both cold-worked and annealed filings. The curves for the former are shown in Fig. 2, and it will be seen that they resemble the hypothetical curves of Fig. 1 if allowance is made for the sloping background.

The data from the sharp lines given by the annealed filings were used to derive the diffraction broadenings, β, by the methods due to Jones[2]. The results are given in the accompanying table. The penultimate column gives the apparent particle size; the last column gives the apparent lattice distortion[3]. It will be seen that the latter is much more nearly constant than the former. Thus despite the extra visual sharpness of the molybdenum lines the detailed analysis shows that in this case the broadening is due mainly to lattice-parameter variation.

We have thought it advisable to use filings for these preliminary experiments since we are more familiar with the methods of analysing the results. The accuracy of these methods is greater than appears to be generally realized; it is definitely capable of distinguishing between broadenings proportional to $\sec\theta$ and $\tan\theta$, even in line 3 of cold-worked copper. This was shown in a recent note from this laboratory[3]. An examination of the table that accompanied this note will show that if the broadening were due to small crystallite size, β should be of the order of 0·6 mm. at low angles. Since the total breadth of line 3 is only 0·64 mm., the diffraction broadening could scarcely be so great as this even if the methods of analysis were much less accurate than we suppose. We realize, however, that the nature of plastic deformation may be different in massive metal and in filings and we hope to perform further experiments, more closely resembling Dr. Wood's, to see if there is any difference in the two cases.

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A. R. STOKES.

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Cambridge.
June 2.

[1] Wood, NATURE, 151, 585 (1943).
[2] Jones, *Proc. Roy. Soc.*, A, 166, 16 (1938).
[3] Stokes, Pascoe and Lipson, NATURE, 151, 137 (1943).

Value of the pF Scale of Soil Moisture for Expressing the Soil Moisture Relations of Wireworms

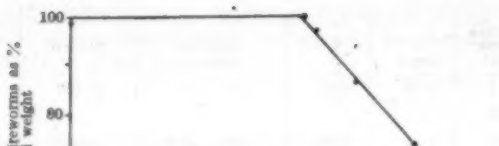
Subklew[1] and Woodworth[2] have shown that the cuticle of wireworms, Agriotes spp. and Limonius spp., is freely permeable to water, and the latter author also that it is permeable to arsenite ions. These findings have been corroborated and extended at Rothamsted, to show that when immersed in solutions of sucrose of varying concentration, anæsthetized wireworms (anæsthetized to prevent drinking and excretion) behave as an osmotic system bounded by a semi-permeable membrane.

Concentration of sucrose ..	0·00	0·15	0·30	0·45	0·60	0·75	1·00*M*.
Osmotic pressure in atmospheres	0	3·80	7·54	11·34	15·27	19·35	26·42
Vapour pressure depression (per cent) ..	0	0·28	0·56	0·85	1·14	1·45	1·98
Weight of wireworm after 4 days as per cent original weight ..	122·5	116·3	102·3	91·5	85·2	82·0	80·6

These observations show that had the wireworms been placed in a 0·33*M* sucrose solution they would not have changed in weight. This solution has a vapour pressure of about 99·4 per cent or a vapour pressure depression of 0·6 per cent.

Observations were also made on normal wireworms kept in samples of a rich loam soil at a series of moisture contents. The vapour pressure depressions of the various moisture contents were determined by the methods given by Schofield and Botelho da Costa[3] and Davidson and Schofield[4].

The accompanying graph is a log/log plot of the weight of the wireworms after seven weeks (original weight taken as 100) against the vapour pressure depression of the soil sample in which they were placed. When the depression is less than about 0·6 per cent the wireworms show no consistent change in weight, intake of water through the cuticle being balanced by excretion. When it exceeds 0·6 per cent,



Abcissa (top): Vapour pressure depression (%).
,, (middle): *p*F.
,, (bottom): Moisture (%).

water is lost chiefly through the cuticle, there being little or no excretion. In the drier soils the vapour pressure depression is due mainly to the 'suction' of the soil moisture, that is, to the fact that the water retained in the soil pores has a pressure less than that of atmospheric pressure. A suction of eight atmospheres produces a depression of 0·6 per cent. Adopting the scale proposed by Schofield, in which *p*F represents the logarithm of the height in centimetres of a column of water corresponding to the suction, we can say that the wireworms were in moisture equilibrium with the soil at *p*F 3·9.

Further experiments with other soils have confirmed that the rate of loss of water is governed by the 'suction' and not by the moisture content of the soil.

Type of soil	% Moisture content at *p*F 5·0	Weight of wireworms after 5 weeks as % original wt.
Woburn Sandy ..	4·03	56·7
Rothamsted allotment ..	7·52	55·9
Rich loam	10·38	56·9
	*p*F at a moisture content of 10·38	
Rothamsted allotment ..	4·1	86·9
Woburn Sandy	3·6	102·2

It is quite clear that the *p*F scale suitably expresses the dryness or wetness of a soil in relation to the loss of weight of wireworms, and should prove of value in studies of a similar kind.

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May 28.

[1] Subklew, W., *Z. morph. u Oekol. Tiere*, **28**, 184 (1934).
[2] Woodworth, C. E., *J. Agric. Res.*, **57**, 229 (1939).
[3] Schofield, R. K., and Botelho da Costa, J. V., *J. Agric. Sci.*, **28**, 644 (1938).
[4] Davidson, A. L. C., and Schofield, R. K., *J. Agric. Sci.*, **32**, 413 (1942).

Effect of *p*-Aminobenzoic Acid on Defective Cultures of Bacteria

IT has been shown by C. E. Cahn-Bronner[1] that the phenomenon of bacterial zones can be produced by partial starvation.

Some aerobic bacteria and yeasts were found to grow in a layer under the surface of the fluid culture with increasing starvation such organisms were more sensitive to oxygen, which had a mildly bacteriostatic effect on them.

This phenomenon of sensitivity to oxygen is due to lack of easily oxidizable substances, mainly carbohydrates, in the medium (acting as oxygen acceptors). This type of growth is also observed in cultures of *B. subtilis* grown on semi-synthetic medium containing hydrolysed casein. Strains of *B. subtilis* grown on digest broth produce a normal growth after 24 hours in the form of diffuse turbidity and a pellicle on the surface of the medium, whereas on the synthetic medium described by Leonard and Holme[2], with 0·1 per cent acid-hydrolysed casein instead of proteose peptone, there was weak growth in the form of slight turbidity in the deeper layers of the culture after 24 hours but no pellicle on the surface. In absence of hydrolysed casein, growth was still less noticeable, and it was several days before the turbidity was sufficient to be estimated. Surface growth with normal pellicle formation occurred when *p*-aminobenzoic acid was added to the medium in a concentration of 1 : 2,500 to 1 : 1,100,000. In absence of hydrolysed casein, however, surface growth did not take place within 24 hours.

The addition of 4 per cent human serum to the synthetic medium had the same effect as the addition of *p*-aminobenzoic acid (and hydrolysed casein). Addition of sulphonamide compounds having antibacterial properties in dilutions up to 1 : 100,000 inhibited the surface growth-promoting effect of *p*-aminobenzoic acid in the synthetic medium. This probably explains Mandelbaum's observation on bacterial asthenia[3].

Another example of defective growth under the influence of sulphonamide drugs is shown by cultures of *Ps. pyocyanea* in synthetic medium, in which not only is there scanty pellicle formation but also a deficiency of pigment formation over a period of 24 hours when sulphonamides are added in dilutions from 1 : 5,000 to 1 : 50,000. *p*-Aminobenzoic acid antagonized the adverse effect of the compounds in dilutions up to 1 : 50,000.

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[1] *Proc. Soc. Biol. and Med.*, **45**, 454 (1940).
[2] *J. Immun.*, **29**, No. 3, 209 (1935).
[3] NATURE, **147**, 266 (1941).

Archæology as a Science

THE antithesis between history and science as central disciplines in "education for citizenship" can be resolved by making history more archæological and recognizing that archæology is a science. Mr. Hansel's just complaint[1] that "the humanities specialize in inhumanity—instruction in the accumulated evil, strife and intrigue of the ages" does not apply to prehistory, which is exclusively archæological—and archæology does not stop short when written history begins. For archæology, evil is not cumulative—one might be tempted to say, is what is not cumulative. In the archæological record (in a

Mesopotamian *tell*, for example) the destruction wrought by strife is overshadowed by reconstruction. What archæology reveals is precisely "the progress of mankind—of art, science and industry" from the painted caves of mammoth-hunters not only to the early cities of Sumer and Crete but also right down to Manhattan and Magnitogorsk. Flint axes and rotary querns, the history of which is provided by archæology alone, are just as much embodiments of science as the cyclotron. The cowrie shells from the Mediterranean adorning a Cro-Magnon skeleton in central France 30,000 years ago and the seals imported from India to Ur 4,500 years ago are just as reliable indexes of intercourse (and so of the pooling of ideas) as Board of Trade lists.

On the other hand, the methods of archæology—accurate and dispassionate observation, systematic comparison and classification, the continual reference of explanatory generalizations to the concrete data derived from observation—are truly scientific. An archæological excavation is an experiment, albeit an experiment that can never be repeated; it should be resorted to, as Collingwood insisted, primarily to test a hypothesis. Archæologists also find out by experiment how pigmy flints were made, how pots were coloured and how the ramparts of forts were 'vitrified'[2].

Prehistoric archæology at least may be deemed to have become a science in 1859. In that year Evans and Prestwich, by confirming Boucher de Perthe's claims as to the antiquity of his artefacts from the Somme gravels, vindicated the existence of pleistocene man; and Darwin, by winning acceptance for the view of man as part of Nature, not only made human history a continuation of natural history, but also gave Nature a history as well as man (as Millar so ably insists in "Science and History"). The methods of prehistory have, especially during the last twenty-five years, been increasingly applied to the study of historical periods too. Hence a lesson in archæology, even if it consist only in the comparison and classification of rusty bolts and broken tobacco-pipes from a town rubbish pit, could be at once a lesson in science and a lesson in history. But not only should it be "more stimulating and elevating", but also more interesting and easier to understand than lists of kings and battles, persecutions and proscriptions.

The corollaries would be, on one hand a more generous treatment of archæology by the State and local authorities, on the other a fuller recognition of the subject's scientific status by universities and institutions. More space, more staff and better equipment are required if existing archæological collections are to be made genuinely educational. In Scandinavia, Czechoslovakia and the U.S.S.R., I have been almost embarrassed by the streams of school classes being taken through museums by their teachers; in few museums in Britain are the archæological galleries large enough or the exhibits so arranged as to encourage this procedure. Funds are needed for further excavations not only to enlarge collections and provide sites for educational visits, but also and more seriously to recover the context within which dead monuments and relics can come to life. A more prominent position might be given to archæology in university curricula even where archæological departments already exist; for the universities must provide the teachers of archæological history and are best fitted to direct research and experiments that cannot be repeated. Finally, the contacts between archæologists and (as I should like to put it) the other men of science might be made closer than they are and given formal recognition.

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[1] NATURE, **151**, 168 (1943).

[2] Childe and Thorneycroft, "The Experimental Production of the Phenomena of Vitrifaction", *Proc. Soc. Antiquaries Scotland*, **72**, 44.

Fortieth Anniversary of the University of Peiping

THE first volume of a book commemorating the fortieth anniversary of the foundation of the University of Peiping was recently published here. The distribution was to have been from Shanghai, but owing to war conditions it is doubtful if any copies were ever sent out. The following is a list of the papers contributed to the volume.

Chang Hsi-Chih: "Observations on the Geological Structural Features in Western Yunnan".

Chang Hsi-Chih and Y. C. Sun: "New Graptolite Faunas from Lientan, Kwangtung".

Lu Yen-Hao: "Ontogeny of *Ptychoparia Szechuanensis* Sun".

Y. C. Sun: "On the Occurrence of Fengshanian (late Upper Cambrian) Trilobite Faunas in Western Yunnan".

Y. C. Sun: "The Uppermost Permian Ammonoids from Kwangsi and their Stratigraphical Significance".

H. C. T'an: "Preliminary Report on the Geology of the Tzuhsing Coal Field in Southern Hunan".

H. C. Wang: "Geology of the Kunming Region".

Yung Chung-Chien: "Preliminary Notes on the Lufeng Saurischian Remains".

Yueh-Chiang Chen: "Notes on some Freshwater Amphipods of Peiping".

Man-Chiang Niu: "The Anatomy of a Salamander, *Triturus Orientalis* (David)".

Man-Chiang Niu: "A Comparative Study of the Skeletons of *Ophiocephalus argus cantor* (Ophiocephalidæ) and *Parasilurus asotus* L. (Siluridæ) with those of *Carassius auratus* L. and *Ctenopharyngodon idellus* C. and V. (Cyprinidæ)".

Chia-Tui Shen: "The Larval Development of Some Peiping Caridea—Caridina (Atyidæ), Palæmonetes and Palæmon (Palæmonidæ).

H. C. Yin: "Effect of Auxin on the Pigment-content, Respiration, and Photosynthesis of *Chlorella vulgaris*".

T. L. Woo: "Anthropologische Studien über die Chinesische Patella".

Wentworth Chu and Chung-Kwei Chang: "Transients of Resistance-terminated Dissipative Band-Pass Electric Wave Filters".

Edith Ju-Hwa Chu: "A Modified Procedure for Preparing o-Bromobenzoic Acid".

S. L. Chien and Y. F. Sui: "The Dipole Moment of 2,2', 4,4-Tetranitrodiphenyl".

If any scientific workers in Britain or America would like to receive copies of any of these papers, we can arrange to send them in typewritten or mimeographed form. Requests should be addressed through Dr. J. Needham, via the British Council, 3 Hanover Street, London, W.1.

CH'ANG CH'ING-YUEH
(Professor of Botany, University of Peiping).

JOSEPH NEEDHAM
(British Scientific Mission in China).

SUN YÜN-CHU
(Professor of Geology, University of Peiping).

Kunming, Yunnan.
March 18.

RESEARCH ITEMS

Origin Myth of the Acoma Pueblo Indians

M. W. STIRLING has brought together all the available information in regard to the origin myth of Acoma (Bur. Amer. Ethnol., Smithsonian Inst., Bull. 135). It seems to be a psychological fact that all thinking peoples like to evolve a creation legend for themselves or to borrow one already in existence. The primordial cow licking a lump of salt in Norse legends and the Babylonian account of the creation of the world, of which the first chapter of Genesis is but a spiritualized version, at once come to mind. Humanity has always been interested in origins, and it likes the start of things to be as simple as possible. Even stories of natural phenomena tend to become simplified into a single account. Thus we find deluge legends almost universally. These generally differ entirely in form, and there is no reason to trace any cultural connexion between them. At the same time, the workings of the human mind are extremely interesting, and the various fundamental legends excogitated by folk in different parts of the world are necessarily of great importance. In the case of the Acoma, everything started with two women who were born underground (how is not stated) at a place called Shipapu. There was also a creative spirit called Tsichtinako who acted as their guardian, brought them to the surface of the ground, gave them images of animals and plants, and showed them how to give these life and how to distribute them to the various points of the compass. Of course in due time human beings were given life, this time apparently through the fertilizing of the women by Tsichtinako himself, and were taught various taboos and ceremonies. All these happenings are reproduced in play-acting when various ceremonies take place during which a ladder is mounted to represent the emergence of the two women from the depths of the earth—the ladder is supposed to represent the rainbow, by the way—and elaborate hunting and other scenes occur, considered to reproduce the instructions given by Tsichtinako. There is also a spirit of evil, as well as what seem to be guardian spirits. These, too, appear in the ceremonies. The 114 pages of the Bulletin—with many full-page illustrations, one in colour—repay careful perusal.

Noctuid Moths at Light Traps in America

H. H. WALKDEN and D. B. Whelan discuss the trapping of owlet moths (Phalœnidæ or Noctuidæ) by means of light in Kansas and Nebraska in Circular No. 643 of the U.S. Department of Agriculture (Nov. 1942). By the use of light traps located at six widely separated points in the Missouri Basin, information was obtained regarding the seasonal occurrence and abundance of a group of moths containing many notoriously injurious pests. During a four-year period (1934–37) 305 species of these moths were captured, totalling more than 525,000 individuals. About 90 per cent of the specimens taken were species of economic significance. More than 36,000 individuals were examined for sex, and it was found that 35 per cent were females but that the sex ratio varied greatly with the species. The number of moths taken differed greatly in the different localities and also from year to year. In general, flights of individual species showed the same trend in all the localities. Species having a single annual generation had rather a short flight period, usually from late August until early October. *Chorizagrotis auxiliaris*, however, had an enormous flight in May and June, followed by a much lighter flight in the fall. Owing to the overlapping of broods the flights of different generations of multiple-generation species were not clearly defined. It is considered that the data obtained are basic to, or of value in, the consideration of cultural control and other methods for the suppression of the various pests involved. Although the response to light varies with different species, it is probable that the number of individuals recorded is a fairly reliable estimate of the relative abundance of the species in the areas concerned.

Studies in Siricidæ or Wood-wasps

R. B. BENSON has discussed the members of this family that occur more especially in Europe and southern Asia (*Bull. Entomol. Res.*, **34**, 27; 1943). Included in his paper is also a key to the genera of the world. The two subfamilies Siricinæ and Tremecinæ are taken to be valid groupings that are supported by biological differences. So far as is known the former are wholly associated with conifers and the latter with angiospermous trees. Two ratios are introduced as characters for specific differentiation, namely, the ovipositor/fore-wing ratio and the sawsheath/ovipositor ratio. These ratios were found to hold good in all the specimens in the British Museum collection and, furthermore, were found not to vary with the size of the insects. In dealing with the British members of the Siricidæ it is suggested that *Urocerus gigas* subsp. *taiganus* nov. and the form of *Sirex juvencus* L. with entirely black antennæ may be native in the Caledonian forest. The extinct family of the Pseudosiricidæ, the remains of which are common in the Upper Jurassic strata of Bavaria, is remarkably similar to the Siricidæ but the cross-veins in the fore-wings are greatly reduced. Since it is unlikely that these cross-veins, after having become lost in the Jurassic Pseudosiricidæ, should have been regained in modern sawflies it is considered that the first-named group could not have been ancestral to the Siricidæ as believed by some workers. The paper concludes with a list and short discussion of the Oriental and Himalayan Siricidæ.

A New Source of Pectin

PRACTICAL importance may be attached to the discovery, reported by T. P. Ghose and S. Krishna in *Indian Forest Leaflet* No. 23, 1942, from the Forest Research Institute, Dehra Dun, that the seeds of *Tamarindus indica* contain a very high proportion of pectin (some 58 per cent of the kernel being obtained as a crude alcohol precipitate). The tamarind is cultivated throughout India, Burma and Ceylon, mainly for the sour fruit, an enormous quantity of which is consumed; at present the seeds are usually thrown away, so that if arrangements can be made for their retention and collection a low-priced source of pectin should be available and one which permits readily of storage and transport until such time as it is convenient to extract the pectin. Particulars are given of a method of extraction and isolation of the pectin, which readily forms a firm jelly with suitable proportions of sugar and citric acid.

Fruit Production

M. B. Crane and A. G. Brown (*J. Genet.*, **44**, 160; 1942) show that in some varieties of plums pollination with different varieties gave various differences

in the time of maturity and in the size of the fruit. The pollen influences the fruit in so much as defective embryos give rise to earlier ripening and smaller fruits. The developmental differences in the fruit are an expression of different degrees of seed developments. Thus seedless fruits from diploid × hexaploid ripen first, seeded fruits of $2X \times 4X$ ripen next, and $2X \times 2X$ ripen last. These authors and D. Lewis (*J. Pomol.*, **20**, 40; 1942) point out that seedless fruits of Fertility and Conference pears have been obtained after frost treatment.

Deep-Focus Earthquakes and Aftershocks

Ross R. HEINRICH discusses this question in connexion with the earthquakes which centred near the Ecuador-Colombia border during May, June and July, 1942 (*Earthquake Notes*, **14**, Nos. 1 and 2; 1942). This series apparently began with a very violent shock on May 14, 1942, at 2h. 14m. U.T. and ended with a widely recorded shock on July 12, 1942, at 5h. 06m. U.T. Examination of the data so far received by the Central Station of the Jesuit Seismological Association, and of the St. Louis, Florissant, Cape Girardeau and Little Rock seismograms reveals difficulties in the interpretation of *S* and the determination of the depth of focus. This is not unknown in the case of earthquakes in the same region. The *S* phase is characterized by an emersio followed at a fair interval by an impulse of considerable magnitude. The interval and general character of the *e* and *i* vary on different components and instruments. Moreover, in the distance range of the North American stations the *S* phase is preceded by *PS*, and this adds further to the confusion of the interpretation. The strength of the preliminary phases as compared with the surface waves would suggest deep-focus earthquakes, and this interpretation agrees with the macroseismic evidence. However, *pP* and *sS* are difficult to discern though at St. Louis the $(sS–S)/(pP–P)$ ratio suggests a focal depth in the region of 500 km. If the above interpretation is correct, this swarm should furnish some interesting data on deep-focus earthquakes, but whatever the final analysis, it seems evident that these earthquakes are genetically associated.

Tuberculin Proteins

F. B. Siebert and J. W. Nelson (*J. Amer. Chem. Soc.*, 65, 272; 1943) have shown that tuberculin contains at least two protein components which can be distinguished by different mobilities in electrophoresis. The molecular weights appear to be about 32,000 for the slower and about 16,000 for the faster. Both have immunological specificity, but the larger one is more potent as a tuberculin and more antigenic. The smaller molecule may elicit antibodies which appear with the faster serum components, α-globulin or even albumin.

Acyl Migration in Steroids

A REMARKABLY facile acyl migration, so far without analogy in the steroid series, has been found by V. A. Petrow, O. Rosenheim and W. W. Starling (*J. Chem. Soc.*, 135; 1943) to occur in the monoesters of *cis*-Δ^5-cholestene-3 : 4-diol. The 3- and 4-monoesters were prepared by methods described, a new and elegant method being used for the preparation of the 4-esters from cholesterol. An acyl migration from C_3 to C_4 occurs on warming the 3-monoacetate of the *cis*-diol in acetic acid solution, the reaction being reversible, and another example was found in the successive substitution of chlorine for hydroxyl and hydroxyl for chlorine at C_4 in 3-acetoxy-Δ^5-cholesten-4-ol. An intermediate formation of orthocarbonic esters, analogous to that occurring in acyl derivatives of glycerol and carbohydrates, is suggested as an explanation of the reaction, but an alternative mechanism involving a transannular tautomerism is also discussed.

Welding of Cast Iron

THE welding of broken or worn iron castings is reviewed by J. G. Pearce (*Quart. Trans. Inst. Welding*; Oct. 1942), and a preliminary report of some experimental work on the same subject by W. J. Driscoll appears in the same publication. It is shown that welding can be successfully applied to a wide range of repair work more cheaply and expeditiously than by replacing the casting itself. The most popular process is by bronze welding, which is the only one available for malleable cast iron. When employing this method, little preheating is required, and since the fusion temperature of the bronze is well below that of the cast iron, there is less risk of cracking or distortion. The weld is but little weaker than the parent casting and is easily machined. The main disadvantages of this process are that the weld is unsuited to service at elevated temperatures, and that the penetration is not great. Using a fusion method there is much better penetration, and, especially in the case of oxy-acetylene welding, good strength. The higher temperatures involved in the welding result, however, in a greatly increased risk of distortion and possibly even of the cracking of the casting under repair.

Solar Prominences and Sunspots in 1937

OBSERVATIONS of solar prominences for 1937 were conducted at the University of Valencia with the equatorial Zeiss, aperture 15 cm. and focal length 2·2 metres; a spectroscope which was previously at the Observatorio Astronómico de Madrid was adapted to the Zeiss for prominence work (*Bol. Ast. Observ. Madrid*, **2**, No. 8; 1942). The first part supplies the usual information on prominences, date and time, position angle, heliographic latitude, height, etc. Letters in the last column are used to classify the prominences according to their brightness, the chromosphere being used as the basis for this comparison. Thus, *v* denotes a prominence which is as bright as the chromosphere and *vv* signifies a prominence of the brightest class observed. When the letter *d* is used the prominences are considered to be well defined, though less bright than the first two, and when *dd* appears the light is so feeble that it is comparable with that of the spectrum. The second part shows the distribution of the prominences in zones of 5° area, under each quadrant separately, and the third part gives the mean areas in each zone for every month of the year. Part four shows the number of prominences and their areas for the various zones in each quadrant, and the last part supplies a useful summary of the work for each month. The last eight pages are devoted to the observations of sunspots in 1937 at the University of Valencia. Most of the observations were carried out by M. Martin Lorón and were checked by R. Carrasco. Reductions of observations and computations were effected by E. Gullón.

CANCER RESEARCH

THE annual report for 1943 of the director of the Imperial Cancer Research Fund* makes encouraging reading, not because any startling or dramatic results emerge, but because the problem continues to be assailed on sound scientific lines by a number of different methods which are fully co-ordinated. Dr. W. E. Gye reports that during the past year work has centred almost entirely on experiments relating to mammary cancer in mice, the induction of cancer with pure chemicals, the action of hormones on the pituitary body and on the prostate gland, and to chemotherapy.

As regards carcinogenesis, H. G. Crabtree's earlier work has shown that a series of halogen compounds, graded with respect to their power of checking cell-glycolysis, could retard the development of skin tumours induced by pure chemical substances. The halogen compounds used could also affect other chemical cell-mechanisms, in particular those involving the sulphydryl group; for example, glutathione, enzymes containing sulphydryl groups as active centres, or the normal synthesis of proteins with sulphur-containing amino-acids in their essential composition. Recent observations suggest that sulphur metabolism is a factor in the artificial induction of cancer; it may also assist in determining the occurrence of spontaneous mammary tumours in inbred strains of mice.

The general growth-inhibiting properties of many carcinogenic and non-carcinogenic hydrocarbons seem to be related to the depletion of sulphur-containing amino-acids which co-operate in their elimination. Experiments have been made on the effect of tumour induction when sulphur metabolism is disturbed. One method consisted in the application of bromobenzene to the skin. This substance in the organism is detoxicated by combining with cysteine and is then eliminated as a mercapturate. Crabtree has demonstrated the inhibiting effect of bromo-benzene on the formation of skin tumours in mice by 3 : 4-benzpyrene. The earlier types used in these inhibiting experiments, by virtue of their mobile halogen atoms, can react with the sulphydryl type with elimination of halogen acid, while the present type reacts by a coupled oxidation in which the relatively unreactive halogen remains as a constituent of the resulting mercapturate. This inhibition of tumour induction probably occurs with both types of compounds under conditions of localized sulphur deficiency, which suggests that sulphur metabolism is intimately concerned in the processes of chemical carcinogenesis.

Dr. B. D. Pullinger has continued her study of the Deelman phenomena, that is, the localization of tumours in scars and healing wounds. Her experiments indicate that trauma, as represented by excised wounds, has a slight stimulating action in increasing tumour incidence. Her work also suggests that the intervention of some specific carcinogenic chemical is necessary to stimulate or originate tumour growth, as well as the added non-specific action of trauma.

Cramer and Horning's work has shown that there is a reciprocal action between the sex organs and the pituitary body. Pursuing this work, Dr. Vaquez-Lopez has studied the effect of œstrinization in a number of species of animals. In the hamster, for example, when œstrogenic substances (œstradiol benzoate and diethylstilbœstrol) were subcutaneously implanted, the epithelial cells of the pars intermedia of the pituitary body multiply and invade the posterior lobe, which consequently enlarges. The invasion often replaces the whole of the pars nervosa and may extend along the neurohypophysis to the brain. In mice a similar enlargement takes place in the anterior lobe of the pituitary body. This hormonal stimulus causes an extension of a normal process; it is an invasive phenomenon, not a new growth, for there is no defensive reaction of nerve tissue to the emigration of intermedia cells, such as occurs in the event of an invasion by alien cells. Long-continued treatment with œstrogens gives rise to profound changes not only in the organs of internal secretion, such as pituitary gland, the suprarenal glands and the islets of Langerhans in the pancreas, but also in the testis, the mammary gland and the prostate. This work, then, bears upon the enlargement of the prostate in old age and, possibly, its tendency to malignant disease. Horning is now investigating the effects of œstrinization on the prostatic glands of pure-line mice of high and low incidence of mammary cancer.

Interesting work has been done by Dr. R. J. Ludlow and Miss H. Barlow on tissue cultures. The cell characteristics of primary tumours, both spontaneous ones and those induced by œstrin and chemicals, have been studied, as well as the action of malignant and non-malignant cells on fibroblasts *in vitro*. The latter research leads to the conclusion that some product of the metabolism of growing epithelial cells stimulates the growth of fibroblasts.

Mammary cancer in inbred strains of mice, on which Bittner, Andervont, Little and W. S. Murray in America have recently done much work*, has been further studied by Dr. Ludford and Dr. L. Dmochowski, and Dr. Ludford and Miss Barlow have continued their work on chemotherapy.

Knowledge of cancer increases year by year, and this report is no mean contribution to a problem which is gradually emerging from obscurity.

* Fortieth Annual Report, 1942–1943, of the Imperial Cancer Research Fund. Pp. 32. (London: Imperial Cancer Research Fund, 1943.)

* Bittner, *Trans. Stud. Coll. Phys.*, Philadelphia, **8**, 129 (1941).

PROTECTIVE SYSTEMS FOR RURAL ELECTRICAL DISTRIBUTION

A SYMPOSIUM of four papers on this subject was presented before the Institution of Electrical Engineers in London on May 12. In the first paper, by D. C. Field on systems up to 33 kV., the general principles of protection are discussed, emphasis being laid on the importance of considering the prevention of faults as well as their isolation. From an analysis of the causes of interruptions, which shows that a large number are only transient, and from the special conditions pertaining to a rural system, it is concluded that it is preferable to restrict the number of points at which automatic protection is provided, in order to facilitate the rapid resumption of supply. The methods of protection adopted in one large rural area are briefly described, together with a summary of the experience gained in operating several classes of equipment, including arc-suppression coils, auto-reclose switches and fuse-gear.

The second paper, by O. Howarth, is confined to 11 kV. networks and consists of a description of the

area supplied by the Lancashire Electric Power Co., and of the nature of supplies afforded in that area. The 11 kV. distribution system and the protective arrangements employed thereon are described, and figures showing availability of supply to consumers during a period of one year are given. The testing necessary to ensure satisfactory functioning of the protective gear is also dealt with. The experience of the Lancashire Electric Power Co. indicates that with a duplicate tail-end feeder system, simple overload and earth-leakage protection will ensure the minimum of interruption of consumers' supplies provided adequate tests are made to prove the reliability of the gear. Where two or more feeders operate in parallel between sending and receiving stations, and provided the load tapped off along the route does not exceed about 50 per cent of the normal load of the feeder, very satisfactory discrimination can be obtained with parallel-feeder protective systems.

In the third paper, by R. W. Steel and A. W. Allwood, systems up to 33 kV. are considered, and the importance of installing suitable and efficient protective apparatus on rural networks, at all stages of their development, is emphasized. A typical protective scheme, including arc-suppression coils, for an 11 kV. and 33 kV. rural distribution system which has been put into operation in a particular area of supply is described, and the reasons leading to its adoption are given. The practical difficulties met with in securing efficient operation and of carrying out proper maintenance are discussed and some statistical records of fault interruptions are presented. These indicate the number and type of faults causing total or partial failures of supply and show the conditions under which the protective gear is called upon to function. The nature of the faults which occur on rural networks is analysed and a suggested standard form of keeping fault statistics is put forward for general adoption by undertakings distributing in rural areas.

The fourth paper, by K. I. Brown, deals more particularly with the automatic selective isolation of sustained earth-faults on a network protected by Petersen coils, and explains what is believed to be a unique method evolved for the protection of a grid network of 37·5 kV. transmission lines against line-to-earth faults, which enables automatic selection and isolation of a section subjected to a sustained fault to take place without utilizing earth fault current for the operation of protective relays, or pilot wires between sectionalizing stations remote from one another. The scheme provides for the installation of Petersen coils together with special automatic selectors and associated equipment, and has been employed with considerable success since 1936 for protection of the Ganges Canal hydro-electric grid in the United Provinces, India.

The paper shows that by introducing Petersen coils and automatic selector equipment to the system, almost complete immunity from outages due to temporary line-to-earth faults had been achieved, and that in the case of a sustained line-to-earth fault the affected section can be selected and isolated automatically within a period of 30 sec. from the instant of fault, without any 'kick' being experienced by the power stations. No pilot wires are required between selector stations. The existing overload relays continue to protect the system against line-to-line faults, and if desired the original form of earth-leakage protection may be restored to the system by the manipulation of earthing switches.

To certain criticisms of the scheme that (*a*) there is the possibility of line surges occurring due to switching on a system entirely protected by Petersen coils, and (*b*) the interruption in supply to substations connected to healthy lines between switching points must of necessity sometimes be experienced, it can be replied that no surge effects have been observed and the transformers, switchgear and line insulators have not been affected thereby, while since the majority of faults recorded clear before any sectionalizing takes place and as sustained earth faults are infrequent, momentary interruptions to load points are few. The probability of the selectors having to complete full sequence of operation in the event of a sustained earth fault is small, as there are eleven sections on which the fault may have occurred and it is only in the event of the fault being on the last section in the series, or in a substation structure, that the full sequence of operation takes place.

THE TERMITES OF AUSTRALIA

By Dr. A. D. IMMS, F.R.S.

UNDER the above title there has recently appeared a timely and much needed monograph*. The author, Mr. G. F. Hill, has been an active worker on termites for many years and has an unrivalled acquaintance with these insects in so far as Australia is concerned. There are many difficulties to be contended with in the study and investigation of termites, and it is for this reason that monographs are badly needed from nearly all parts of the world that are inhabited by these creatures. Excluding the United States, which has a relatively meagre termite fauna, Australia is to be commended in giving a leading hand by furthering publication of an account of her native species. But the availability of a competent authority is about two thirds the battle—other lands are not so far equally favoured. India, perhaps more than any other part of the British Commonwealth of Nations, needs a proper monograph on her rich and vast termite fauna, that is productive of almost incredible damage to human effort. A sound monograph on this order is worth many of those on the more obscure orders, and it is to be hoped that a competent worker will be forthcoming one day, not too far distant, who will cope with the task.

But, as previously said, the difficulties are manifold when it comes to identifying these insects. The soldier caste affords the best and most reliable character—the winged imagines are seasonal and not so often met with in consequence, while the workers (that have earned for termites their notoriety as destroyers of products serving man's convenience) show ill-defined features that make their specific determination a thing of great uncertainty. Apart from the incidence, then, of three different castes of individuals in each species, it needs to be taken into account that two or more different species may inhabit the same mound or piece of wood. It often happens that two or more species of very distinct habits are almost indistinguishable in form and structure, and that individuals of the same species may differ very much in different regions so as to be

* Termites (Isoptera) from the Australian Region. By Gerald F. Hill. Commonwealth of Australia Council for Scientific and Industrial Research. 479 pp., 353 text figs. and 24 plates. (Melbourne, 1942.)

mistaken as belonging to more than a single species. Difficulties of this kind have naturally given rise to much confusion regarding the specific identity of so many of the Australian termites, as elsewhere.

Much spade work has been undertaken by Mr. Hill in getting discrepancies of this type properly cleared up. During the progress of this work about nine thousand termite colonies have been examined. Altogether 217 species have been recorded from the region under review, which includes also New Guinea and islands south of the equator between 140° E. longitude and 170° W. longitude.

Among this rich fauna is included the most primitive of all termites—*Mastotermes darwiniensis*, which happens, also, to be the most destructive among the Australian species. A thorough study of this 'key' form should throw much light on the many outstanding problems of termite economy and would form an admirable subject for a young and promising Australian zoologist to embark upon. The present monograph loses nothing by the letterpress being reproduced photolithographically owing to need for economy, and the line drawings form a valuable adjunct. In a short notice of this kind little more can be written other than to direct attention to the importance and excellence of the work in question, which will probably long remain a standard monograph.

FORTHCOMING EVENTS

Saturday, July 3

NUTRITION SOCIETY (JOINT MEETING WITH THE FOOD GROUP OF THE SOCIETY OF CHEMICAL INDUSTRY) (at the London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1), at 11 a.m.—Discussion on "Milk" (Chairman: Prof. H. D. Kay).

LONDON MATHEMATICAL SOCIETY (JOINT MEETING WITH THE LONDON BRANCH OF THE INSTITUTE OF PHYSICS) (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 2 p.m.—Dr. A. C. Aitken, F.R.S.: "Matrices in Practical Mathematics"; Dr. L. J. Comrie: "Computational Methods and Mathematical Tables"; Mr. H. L. Blackburne: "Mathematical Solutions by Models"; Dr. S. Whitehead: "Applications of Elementary Mathematical Processes, with special reference to Circuit Theory".

Saturday, July 3—Sunday, July 4

TOWN AND COUNTRY PLANNING ASSOCIATION (at the Waldorf Hotel, Aldwych, London, W.C.2), at 10.30 a.m.—Conference on "Town Planning, Housing and Full Employment".

Tuesday, July 6

ROYAL SOCIETY OF MEDICINE (at 1 Wimpole Street, London, W.1), at 5 p.m.—Annual Meeting.

Friday, July 9

ROYAL ASTRONOMICAL SOCIETY (at Burlington House, Piccadilly, London, W.1), at 4.30 p.m.—Dr. R. O. Redman: "Spectrographic Observations of the Total Eclipse of 1940 October 1: 3: The Spectrum of the Extreme Limb of the Sun"; Dr. R. v. d. R. Woolley: "Note on Convection in the Sun"; Mr. A. W. J. Cousins: "Photovisual Magnitudes of Southern Stars".

INSTITUTE OF PHYSICS (JOINT MEETING WITH THE INSTITUTION OF ELECTRONICS) (in the Reynolds Hall, College of Technology, Sackville Street, Manchester), at 7 p.m.—Dr. A. Sommer: "Photo-electric Cells".

Saturday, July 10

INSTITUTE OF PHYSICS (INDUSTRIAL RADIOLOGY GROUP) (at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2), at 2.30 p.m.—Open Discussion on Industrial Radiology.

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

ASSISTANT MISTRESS WITH HOUSEHOLD AND SOCIAL SCIENCE QUALIFICATIONS, INCLUDING BIOLOGY AND HYGIENE—The Clerk to the Governors, Mid-Essex Technical College, Chelmsford (July 7).

LECTURER IN BUILDING CONSTRUCTION, GEOMETRY AND SCIENCE, AND ELEMENTARY MECHANICS in the Junior Building School of the Newport Technical College—The Director of Education, Education Offices, Charles Street, Newport, Mon. (July 7).

ASSISTANT MASTERS FOR (*a*) MATHEMATICS, (*b*) SCIENCE, INCLUDING BIOLOGY, (*c*) ADVANCED MECHANICAL ENGINEERING SUBJECTS, (*d*) ENGINEERING SUBJECTS INCLUDING ELECTRICAL ENGINEERING AND WORKSHOP TECHNOLOGY—The Principal, Enfield Technical College, Queensway, Enfield, Middlesex (July 9).

ASSISTANT MASTER IN THE JUNIOR TECHNICAL SCHOOL, WELL QUALIFIED TO TEACH MATHEMATICS AND SCIENCE—The Principal, Royal Technical College, Peel Park, Salford 5 (July 9).

TEACHER (TEMPORARY) OF SCIENCE AND MATHEMATICS, and a TEACHER (TEMPORARY) OF WORKSHOP PRACTICAL (ENGINEERING) AND TECHNICAL DRAWING—The Principal, Stockport College for Further Education, Stockport (July 10).

JUNIOR LECTURER AND DEMONSTRATOR IN THE DEPARTMENT OF MECHANICAL ENGINEERING—The Registrar, The University, Liverpool (July 14).

DEMONSTRATOR (MAN OR WOMAN) IN THE PHYSIOLOGY DEPARTMENT—The Warden and Secretary, London (Royal Free Hospital) School of Medicine for Women, 8 Hunter Street, London, W.C.1 (July 16).

COMBINED POST OF FULL-TIME (ACTING) RADIOTHERAPIST TO THE LIVERPOOL CANCER CONTROL ORGANIZATION and (ACTING) MEDICAL DIRECTOR OF THE RADIOTHERAPEUTIC DEPARTMENT OF THE LIVERPOOL RADIUM INSTITUTE—The Hon. Secretary, Liverpool Cancer Control Organization, 66 Rodney Street, Liverpool 1 (July 24).

HEADS OF THE DEPARTMENTS OF PHYSIOLOGY, MEDICINE, AND SURGERY—The Bursar, Royal Veterinary College and Hospital, at The University, Reading (October 1).

PSYCHIATRIC SOCIAL WORKER—The Medical Superintendent, Springfield Mental Hospital, Tooting, London, S.W.17.

TEACHERS (MEN OR WOMEN) FOR THE FOLLOWING SUBJECTS FOR THE DAY SCHOOL: JUNIOR MATHEMATICS; MATHEMATICS; GEOGRAPHY; GENERAL SCIENCE—The Clerk to the Governors, South-West Essex Technical College and School of Art, Forest Road, Walthamstow, London, E.17.

TEACHER OF ENGINEERING SUBJECTS—The Principal, Technical Institute and Day Technical School for Boys, Gravesend.

SCIENCE MASTER TO TEACH MAINLY BIOLOGY in connexion with a Pre-Agricultural Course for Boys in the Maidstone Technical Institute—The District Secretary, Mr. A. W. Peacock, 13 Tonbridge Road, Maidstone.

CENTRAL PRODUCTION ENGINEER—The Ministry of Labour and National Service, Central (Technical and Scientific) Register (Reference No. C.1609X), Alexandra House, Kingsway, London, W.C.2.

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